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CONTENTS OF PREVIOUS NUMBER

JULY, 1927. NUMBER 1

The Influence of Pathology on the Development of Pediatrics. Isaac A. Abt, M.D., Chicago.

Respiratory Anaphylaxis: Sensitization, Shock, Bronchial Asthma and Death Induced in the Guinea-Pig by the Nasal Inhalation of Dry Horse Dander. Bret Ratner, M.D.; Holmes C. Jackson, Ph.D., and Helen Lee Gruehl, B.A., New York.

The Relation of Maternal Diet to Hemorrhage in the New-Born. C. Ulysses Moore, M.D., and Jesse Laird Brodie, M.A., Portland, Ore.

Malignant Neuroblastoma: Report of Three Cases. Boris Kwartin, M.D., and J. Russell Twiss, M.D., New York.

Dermatoses Due to Light Sensitization, with Special Reference to the Cutaneous Dangers of Ultraviolet Radiation in Children. Sigmund S. Greenbaum, M.D., Philadelphia.

Sickle Cell Anemia: Report of a Case with Splenectomy. Walter Blair Stewart, M.D., Atlantic City, N. J.

Progress in Pediatrics:
Child Health in the Past. Philip Van Ingen, M.D., New York.

News and Comment.

Obituary:
Abraham Zingher, M.D.

Abstracts from Current Literature.

Society Transactions:
Pediatric Section of the Academy of Medicine of Cleveland.
American Pediatric Society (First and Second Sessions).

Book Reviews.

Directory of Pediatric Societies.

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VOLUME 34 AUGUST, 1927 NUMBER 2

EFFECT OF THERAPEUTIC DOSES OF ULTRAVIOLET RADIATION ON BASAL METABOLISM IN CHILDREN *

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NEW YORK

It has been assumed that there is a rise in basal metabolism following ultraviolet irradiations. However, only two observations on human beings are on record in the literature. Otto Kestner and his co-workers [1] reported an increase in metabolism lasting from twelve to twenty-four hours immediately following irradiations; unfortunately, mention was not made of the length of time of exposures. The other paper was a preliminary report that I [2] made on the effect of therapeutic doses of ultraviolet radiations on children, in which a change in basal metabolism was not noted following irradiation.

In treating patients with ultraviolet radiations, it is of great importance to the physician to know what effect may be expected from such exposures. The increase in blood calcium and in phosphorus is well known. The general improvement in the patient's condition, such as increase in appetite, gain in weight and improved sleep, has been observed, but such changes have not been accounted for satisfactorily. Can any of these changes be ascribed to the supposed change in basal metabolism?

This was the problem that formed the basis for this research. The work was divided into two parts: the first, to determine whether there was a rise in basal metabolism following therapeutic doses of ultraviolet radiation over a long period of time; the second, to discover whether there was an immediate rise in metabolism following each successive treatment.

The ideal subjects for such an experiment would have been organically perfect children of average weight and development. It was impossible to have such children, as this study necessitated a stay in the

* Received for publication, Jan. 21, 1927.

* From the Pediatric Service of Mount Sinai Hospital.

1. Kestner, Peemoller, and Plaut: Die Einwirkungen der Strahlung auf den Menschen, Klin. therap. Wchnschr. **44**:2018 (Oct.) 1923.

2. Fries, M. E.: Influence of Ultra-Violet Radiations on Basal Metabolism in Children, Proc. Soc. Exper. Biol. & Med. **22**:431, 1925.

hospital, under observation, for from four to six weeks. Therefore, the children selected were those in whom there was moderate malnutrition or who were suffering from some minor ailment, and who were willing to remain in the hospital for this period.

TABLE 1.—*Record of Case 1**

Date	Weight in Kg.	Total Calories per Hour	Total Calories per 24 Hours	Calories per Kg. per 24 Hours	Calories per Sq. M. per 24 Hours	Ultraviolet Irradiations: Distance, Inches	Ultraviolet Irradiations: Time, Minutes	Comment
12/13/24	27.7	34.5	828.0	29.8	819	No treatment		Ambulatory; general diet; Benedict apparatus used; hospitalized; 2,130 calories about 10% proteins; Krogh apparatus used
12/20/24	27.7	34.0	816.0	29.4	807			
12/26/24	26.9							
12/27/24	26.9	44.6	1,070.0	36.0	1,070			
1/ 5/25	26.9	36.0	864.0	32.1	864	24	3	
1/ 7/25	26.8	36.5	876.0	32.6	876	22	5	
1/ 8/25	....	....	.....	....	...	20	7	Marked erythema
1/ 9/25	26.8	37.2	892.8	33.3	892.8	18	8	
1/10/25	....	....	.....	....	...	17	10	
1/12/25	27.0	36.1	866.4	32.0	866.4	17	12	
1/13/25	....	....	.....	....	...	16	13	
1/14/25	27.5	39.0	936.0	34.4	926	16	14	Desquamation and pigmentation
1/15/25	....	....	.....	....	...	16	15	
1/16/25	27.5	39.4	945.6	34.3	936	16	15	Burning sensation at night
1/17/25	....	....	.....	....	...	16	15	
1/19/25	27.6	37.3	895.2	32.4	886	16	15	
1/20/25	....	....	.....	....	...	16	15	
1/21/25	27.5	39.1	938.4	34.1	929	16	15	
1/23/25	27.5	34.6	830.4	30.1	822	16	15	
1/24/25	....	....	.....	....	...	18	15	
1/26/25	27.5	39.3	943.2	34.3	933	18	15	
1/27/25	....	....	.....	....	...	18	15	
1/28/25	27.5	39.1	938.4	34.1	929	18	15	
1/29/25	28.0	....	.....	....	...	18	15	
1/30/25	27.2	39.4	945.6	34.7	936	No treatment		Left hospital; ambulatory; Benedict apparatus
1/30/25	27.5	34.9	837.6	30.4	829			
2/ 7/25	27.6	37.0	888.0	32.1	879			
2/14/25	28.2	40.8	979.2	34.7	900			
2/16/25	....	....	.....	....	...	20	10	
2/19/25	....	....	.....	....	...	20	12	
2/21/25	28.7	35.8	859.2	29.9	842	18	14	
2/28/25	28.9	34.7	832.8	28.7	816	..	..	
3/ 2/25	....	....	.....	....	...	19	15	
3/ 5/25	....	....	.....	....	...	19	15	
3/ 7/25	29.0	44.3	1,063.2	36.6	1,032	..	..	
3/ 9/25	....	....	.....	....	...	19	15	
3/14/25	29.1	26.9	645.6	22.1	626	19	15	
3/16/25	....	....	.....	....	...	19	15	
3/20/25	....	....	.....	....	...	19	15	
3/21/25	29.2	....	.....	....	...	No treatment		
3/28/25	29.7	....	.....	....	...			
4/ 4/25	29.7	....	.....	....	...			
4/ 8/25	29.5	35.6	854.4	28.6	829			

* A girl, aged 10; sitting height, 72 cm.; total height, 132 cm.; complexion, fair; diagnosis, healthy child with poor appetite.

Patient 1 was in excellent health, but had a poor appetite; patient 2 was slightly underweight, while patient 3 had a simple goiter. They were admitted to the pediatric service of the Mount Sinai Hospital between December, 1924, and March, 1925, at which time the solar

ultraviolet radiations were negligible and would, therefore, not interfere with the radiations from the lamp.

Before any light treatment was given, the children were trained for a month to use the Krogh basal metabolism apparatus. The determinations were found to be high until the children became accustomed to

TABLE 2.—*Record of Case 2**

Date	Weight in Kg.	Total Calories per Hour	Total Calories per 24 Hours	Calories per Kg. per 24 Hours	Calories per Sq. M. per 24 Hours	Ultraviolet Irradiations: Distance, Inches	Ultraviolet Irradiations: Time, Minutes	Comment
12/ 5/24	20.3	....	.....	....	.....	No treatment		In bed; diet, 930 calories, about 10% protein
12/ 7/24	....	....	.....	....	.....			1,200 calories; about 10% protein
12/12/24	20.4	40	960	47.0	1,245			Krogh apparatus used
12/14/24	....	....	.....	....	.....			1,440 calories; about 10% protein
12/31/24	20.1	52	1,248	62	1,620			
1/ 1/25	....	....	.....	....	.....			1,680 calories; about 10% protein
1/ 5/25	20	36	864	43.2	1,122	24	3	
1/ 7/25	....	....	.....	....	.....	22	5	Ward quarantined to January 15; irradiations stopped
1/ 8/25	20.4	39	936	45.8	1,215	No treatment		
1/12/25	20.4	33.7	808.8	39.6	1,050			
1/14/25	20.4	36.5	876	42.9	1,137			
1/15/25	....	....	.....	....	.....	20	7	
1/16/25	....	....	.....	....	.....	18	9	
1/19/25	20.7	37.3	895.2	43.2	1,147			
1/21/25	20.7	38.9	933.6	45	1,196	No treatment		Ward quarantined to January 24; irradiations stopped
1/23/25	20.7	37.1	890.4	43	1,141			
1/24/25	....	....	.....	....	.....	18	10	
1/26/25	20.9	39.3	943.2	45.1	1,193	18	12	
1/28/25	20.8	39.6	950.4	45.6	1,218			
1/29/25	....	....	.....	....	.....	18	14	
1/30/25	21.2	38.5	924	43.6	1,169	..	..	Erythema
1/31/25	....	....	.....	....	.....	18	15	
2/ 2/25	20.7	42.4	1,017.6	49.1	1,304			
2/ 4/25	....	....	.....	....	.....	18	15	Moderate pigmentation
2/ 6/25	20.9	36.4	873.6	41.7	1,105	18	15	
2/ 9/25	20.7	35.6	854.4	41.2	1,095	18	15	Out of bed
2/11/25	20.9	36.6	878.4	42	1,111	18	15	
2/14/25	20.1	42.3	1,015.2	50.5	1,318	No treatment		Left hospital
3/ 9/25	23.9	41.2	988.8	41.3	1,229			Ambulatory

* A boy, aged 6; sitting height, 60 cm.; total height, 108 cm.; complexion, fair; diagnosis, circulatory asthenia.

the machine. Likewise, any excitement, either pleasurable or disagreeable, such as a party or dental treatment, caused a rise in the basal metabolism. The diet was controlled, being increased gradually when the children learned to eat the hospital food until the food intake was double the estimated basic caloric requirements, with a protein content

of a little above 10 per cent. They were then kept on this diet throughout the control and experimental periods.

The children fasted overnight, fourteen hours, and rested in the prone position from fifteen to twenty minutes before being tested. Three determinations of five minutes each were made and the lowest reading taken, unless the tracing showed some error.

TABLE 3.—*Record of Case 3* *

Date	Weight in Kg.	Total Calories per Hour	Total Calories per 24 Hours	Calories per Kg. per 24 Hours	Calories per Sq. M. per 24 Hours	Ultraviolet Irradiations: Distance, Inches	Ultraviolet Irradiations: Time, Minutes	Comment
12/20/24	20.9	....	.....	....	...	No treatment		In bed; diet, 894 calories about 10% protein
12/23/24	20.9	42.8	1,027.2	49.1	1,268			
12/26/24	21.7	31.7	760.8	35	927			
1/ 1/25	....	....	.....	....	...			Potassium iodide, 0.00005 Gm. daily
1/ 9/25	....	....	.....	....	...			Fever from positive Mantou test
1/14/25	21.4	36.5	876	40.9	1,081			
1/16/25	21.5	31.5	756	36.1	983			
1/20/25	....	....	.....	....	...			Out of bed for one hour
1/21/25	21.5	33.9	813.6	37.8	992			
1/23/25	21.5	34.6	830.4	38.6	1,012			Out of bed for two hours
1/25/25	....	....	.....	....	...			In bed; fever
1/26/25	21.3	34.1	818.4	38.4	1,010	24	3	
1/27/25	....	....	.....	....	...	..	..	Diet, 1,118 calories; about 10% protein
1/28/25	21.5	31.7	760.8	35.3	927			
1/29/25	....	....	.....	....	...	22	5	
1/30/25	21.3	38.7	928.8	43.6	1,146	..	..	Slight erythema
1/31/25	....	....	.....	....	...	20	7	Out of bed for one hour
2/ 2/25	21.5	37.1	890.4	41.4	1,085	18	9	
2/ 4/25	21	36.6	878.4	41.8	1,084	18	10	
2/ 6/25	20.9	41.8	1,003.2	48.0†	1,238	..	..	
2/ 9/25	21.6	31.6	758.4	35.1	924	18	15	Appetite good; moderate pigmentation
2/11/25	20.9	45.6	1,094.4	52.3†	1,351	18	15	
2/12/25	....	....	.....	....	...	No treatment		1,342 calories; about 10% protein
2/14/25	21.5	31.7	760.8	35.3	927			
2/16/25	21.6	31.9	765.6	35.4	933			
2/17/25	....	....	.....	....	...			Discharged from hospital

* A girl, aged 7; sitting height, 58 cm.; total height, 116.5 cm.; complexion, brunette; diagnosis, simple goiter.

† Dental treatment; child excited.

After a control period of one month, the children were exposed three times a week for a month to the ultraviolet radiations from a Hanovian quartz mercury lamp. The efficiency of the lamp was tested by noting its power to produce an erythema. The length of exposure was increased according to the individual reaction. A suberythema dose was sought, but occasionally a moderate erythema was produced. All of the children became pigmented during the course of treatment.

The basal metabolism was determined three times a week on alternate days, following radiations by from twenty to seventy hours. In this

way, any slight immediate effect from the ultraviolet radiations would not interfere with any permanent effect. Tables 1 to 5 record the individual variations.

The patients were dismissed from the hospital after one month's treatment and were asked to return in a month, when a final determination of the basal metabolism was made.

TABLE 4.—*Record of Case 4* *

Date	Weight in Kg.	Total Calories per Hour	Total Calories per 24 Hours	Calories per Kg. per 24 Hours	Calories per Sq. M. per 24 Hours	Ultraviolet Irradiations: Distance, Inches	Ultraviolet Irradiations: Time, Minutes	Comment
11/29/24	42.7	....	.....	....	...	No treatment		Instructed in diet and hygiene
12/ 6/24	42.2	....	.....	....	...			
12/13/24	42.4	42.9	1,029.6	24.2	720			
12/20/24	42.7	48.5	1,124	26.3	786			
12/27/24	42.4	49.9	1,197.6	28.2	837			
12/30/24	42.6	58.1	1,394.4	32.7	975			
1/ 3/25	42.6	53	1,272	29.8	889			End of control period
1/ 7/25	....	....	.....	....	...	24	4	
1/ 8/25	....	....	.....	....	...	22	7	
1/ 9/25	....	....	.....	....	...	20	9	
1/10/25	42.5	56.6	1,358.4	31.9	949			
1/12/25	....	....	.....	....	...	18	11	
1/15/25	....	....	.....	....	...	18	12	
1/17/25	43.5	53.4	1,281.6	29.4	883	16	14	Slight erythema
1/19/25	....	....	.....	....	...	16	15	
1/21/25	....	....	.....	....	...	16	15	
1/23/25	....	....	.....	....	...	16	15	
1/24/25	43.4	47.8	1,147.2	26.4	791	..	..	Slight pigmentation
1/26/25	....	....	.....	....	...	16	15	Appetite improved
1/28/25	....	....	.....	....	...	16	15	
1/30/25	....	....	.....	....	...	16	15	
1/31/25	43.8	55.4	1,329.6	30.3	916	..	..	Erythema from treatment
2/ 2/25	....	....	.....	....	...	16	15	on 30th
2/ 7/25	44.3	48.3	1,159.2	26.1	788	No treatment		Increased pigmentation appetite excellent
2/14/25	43.5	58.6	1,406.4	32.3	956			Slight rhinitis
2/21/25	44.3	48.7	1,168.8	26.3	795			
2/28/25	44.3	49.5	1,188	26.8	808			Rhinitis improved
3/ 7/25	44.7	52.1	1,250.4	27.9	850			
4/ 4/25	44.8	67.8	1,627.2	36.3†	1,106			
4/18/25	45.6	....	.....	....	...			
4/25/25	45.3	....	.....	....	...			

* A boy, aged 13 years and 8 months; sitting height, 82.5 cm.; total height, 165 cm.; complexion, brunette; diagnosis, healthy child with poor appetite.

† Reading high; air leaked into machine.

During the same months, two healthy children (cases 4 and 5) were studied in the outpatient department. Patient 1 was given a rest period after leaving the hospital, and was then studied in the outpatient department after another series of light treatments. These children were observed and trained to use the Benedict basal metabolism apparatus for one month. Their diet and activity could not be controlled, so that

the results from these cases do not give as accurate information as the hospital cases. Only one basal metabolic determination a week could be obtained on these children, as they went to school. Patient 5 received two series of treatments with ultraviolet radiations.

TABLE 5.—*Record of Case* 5 *

Date	Weight in Kg.	Total Calories per Hour	Total Calories per 24 Hours	Calories per Kg. per 24 Hours	Calories per Sq. M. per 24 Hours	Ultraviolet Irradiations: Distance, Inches	Ultraviolet Irradiations: Time, Minutes	Comment
12/ 5/24	32.7	....	.....	....	...	No treatment		Instructed in diet and hygiene
12/13/24	33.0	43.0	1,032	31.27	880			Benedict apparatus used
12/20/24	33.1	36.8	883.2	26.4	761			
12/30/24	33.5	44.3	1,063.2	31.7	908			
1/ 1/25	33.1	41.8	1,003.2	30.3	864			End of control period
1/ 5/25	....	....	.....	....	...	24	3	
1/10/25	33.1	46.4	1,113.6	33.6	960	22	5	
1/13/25	....	....	.....	....	...	20	7	
1/14/25	....	....	.....	....	...	18	8	
1/17/25	33.5	36.1	866.4	25.8	740	..	..	Infection of axillary nodes
1/19/25	....	....	.....	....	...	16	12	Slight erythema
1/21/25	....	....	.....	....	...	16	13	
1/23/25	....	....	.....	....	...	16	16	
1/24/25	33.4	30.6	734.4	21.9	627	..	..	Fluctuation of axillary nodes
1/26/25	....	....	.....	....	...	16	16	
1/28/25	....	....	.....	....	...	16	16	End of first treatment series
1/30/25	33.4	36.3	871.2	26.0	744	No treatment		Slight pigmentation
2/ 7/25	33.4	46.6	1,118.4	33.4	955			
2/14/25	33.9	47.6	1,142.4	33.6	968			
2/16/25	....	....	.....	....	...	18	10	Second series begun
2/28/25	33.4	32.5	780	23.3	666	18	15	
3/ 3/25	....	....	.....	....	...	18	15	
3/ 5/25	....	....	.....	....	...	18	15	
3/ 7/25	33.3	35.3	847.2	25.4	730			
3/ 9/25	....	....	.....	....	...	18	15	
3/11/25	....	....	.....	....	...	18	15	
3/14/25	33.3	29.1	698.4	20.9	602	18	15	
3/16/25	....	....	.....	....	...	18	15	
3/20/25	....	....	.....	....	...	18	15	Slight erythema
3/21/25	33.9	36.1	963.4	25.5	734	No treatment		
3/28/25	34.7	....	.....	....	...			
4/ 4/25	34.2	....	.....	....	...			
4/18/25	34.8	....	.....	....	...			
4/24/25	34.5	....	.....	....	...			

* A girl, aged 11 years and 10 months; sitting height, 77 cm.; total height, 144 cm.; complexion, brunette; diagnosis, healthy child with poor appetite.

RESULTS

Table 6 gives the results in the hospital cases. The average basal metabolic rates during the control, treatment and post-treatment periods are compared. It will be seen that there is no greater variation than 9 per cent—a variation that comes well within the limit of error.

Table 7 gives the results in the two ambulatory cases and in case 1 after the patient left the hospital. Again the average basal metabolic rates before, during and after treatment did not vary more than 10 per cent, except in case 5 during the second series. Here there was a drop of 26 per cent in the basal metabolic rate, although the first series had not shown any change in the basal metabolism. It was impossible to get a final determination following this second series of treatments. As the conditions could not be controlled in the ambulatory cases, this one decrease in basal metabolism cannot be ascribed solely to the ultraviolet radiations.

TABLE 6.—*Comparison of Basal Metabolic Rate in Hospital Cases During Control Period, Period of Treatment with Ultraviolet Radiation and Post-Treatment Period*

Case	Average Total Calories per 24 Hours		
	Before Treatment	During Treatment	After Treatment
1	894.5	909.8	901.6
2	948.8	925	988.8
3	840.6	843.3	763.2

TABLE 7.—*Comparison of Basal Metabolic Rate in Cases in the Outpatient Department During Control Period, Period of Treatment with Ultraviolet Radiations, and Post-Treatment Period*

Case	Average Total Calories per 24 Hours		
	Before Treatment	During Treatment	After Treatment
4	1,203.5	1,255.2	1,327
5 first series	995.4	904.8	1,043
5 second series	1,043	798	Not obtained
1	901.6	850.7	854.4

SUMMARY

1. Three children in the hospital and two in the outpatient department were treated with ultraviolet radiations three times a week.

2. Determinations of basal metabolism were made from twenty to seventy hours following treatment.

3. The basal metabolic determinations did not vary more than 10 per cent, except in the second series of treatment in an ambulatory case. As not all conditions could be controlled in the ambulatory cases, the decline that occurred in this case cannot be attributed solely to the ultraviolet radiations.

CONCLUSIONS

Ultraviolet radiations did not cause any change in basal metabolism, except in one child. It seems justifiable to assume that a series of treatments with ultraviolet radiations will not affect the basal metabolism of the majority of children.

EFFECT OF THERAPEUTIC DOSES OF ULTRAVIOLET RADIATION ON BASAL METABOLISM IN CHILDREN

SECOND PAPER: IMMEDIATE EFFECT *

MARGARET E. FRIES, M.D.
AND
ANNE TOPPER, M.D.
NEW YORK

In previous papers,[1] one of us (M. E. F.) has shown that there is not any appreciable increase in basal metabolism due to ultraviolet radiations over a long period of time.

To determine whether there might be an immediate effect on basal metabolism following ultraviolet radiation, five children were studied in the wards of the pediatric service of the Mount Sinai Hospital from December, 1925, to June, 1926. The fact that the ultraviolet rays from the sun were fairly potent during the later months of this study did not in any way interfere with the experiment, as the immediate effect of the rays was of interest.

Two of the children were admitted to the hospital because of poor appetite; the other three were convalescing from diseases which did not affect their metabolism.

These children were first trained to use the Krogh basal metabolism apparatus until the readings on two different days did not vary more than 10 per cent. Some required only a few days' training, while others required two weeks. Two determinations of five minutes were made each time, as it was found from previous experience that the majority of children became restless during a third reading. This was especially true when the test was repeated several times daily, as was necessary during this study.

In four of these cases the effect on the basal metabolism was determined four hours after a light breakfast consisting of 100 cc. of milk and 20 Gm. of Uneeda biscuits, with a caloric value of 160 and a protein content of 5 Gm. During the experimental period it was essential to give food that would not cause a rise in the production of heat after four hours. The fifth child was given a meal of agar-agar

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* From the Pediatric Service of the Mount Sinai Hospital.

1. Fries, M. E.: Influence of Ultraviolet Radiations on Basal Metabolism in Children, Tr. Soc. Exper. Biol. & Med. **22**:431, 1925; Effect of Therapeutic Doses of Ultraviolet Radiation on Basal Metabolism in Children, Am. J. Dis. Child., published in this issue, p. 159.

jelly, but she disliked it so much that she preferred to go without food during the days of the experiment.

Benedict and Benedict,[2] Soderstrom, Barr and Du Bois,[3] working with adults, and Bauer and Blunt,[4] working with children, showed that there is not an appreciable increase in the production of heat from four to six hours after a light meal of 470 calories, containing 14 Gm. of protein. A breakfast of milk and Uneeda biscuits was chosen in this work because the children liked it; it was similar to their usual breakfast, and so eliminated the emotional excitement caused by dislike of the agar-agar jelly. This emotion in itself was sufficient to affect the basal metabolism; and the meal of milk and Uneeda biscuits never caused an increase in the metabolism four hours later.

During the control period, the children were kept in bed and put on a fixed diet. As the children ate little of the hospital fare at first, this diet had to be increased gradually until the food intake was double the estimated basic caloric requirements, with a protein content a little above 10 per cent. The children were then kept on this diet throughout the control and experimental periods.

During the first part of the experimental period (period of ultraviolet radiations), the children were kept in bed. After one or two weeks, they became restless, and were kept in bed only on the days on which they received irradiations.

The Hanovian quartz mercury lamp was used. Three therapeutic treatments a week were given. The initial exposure was from three to five minutes to chest and back, and each succeeding exposure was increased by from two to four minutes, according to the individual reaction, until an exposure of fifteen minutes was reached. All of the children became pigmented. The quantity of ultraviolet radiations emanating from the lamp was tested by its power to cause an erythema. It was found that as the lamp was older during this experiment than it had been during the previous one, it was necessary to place it at a distance of 20, instead of 30, inches from the child, in order to obtain an equal amount of ultraviolet radiation.

The basal metabolism was determined early in the morning following a fast of fourteen hours. The child was then exposed to ultraviolet radiations while lying on the metabolism table. Another metabolism determination was made immediately after treatment, and again one, two and six hours later. A rest of from fifteen to twenty minutes in

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2. Benedict, F. G., and Benedict, C. G.: A Permissible Breakfast Prior to Basal Metabolism Measurements, Boston M. & S. J. **188**:849 (May 31) 1923.

3. Soderstrom, G. F.; Barr, D. P., and Du Bois, E. F.: The Effect of a Small Breakfast on the Heat Production, Arch. Int. Med. **21**:613 (May) 1918.

4. Bauer, V., and Blunt, K.: Effect of a Small Breakfast on the Energy Metabolism of Children, J. Biol Chem. **59**:77 (Feb.) 1924.

the prone position preceded each determination. The child was wheeled back to bed between tests and allowed to play there, so as to avoid the possibility of emotional depression or restlessness. The small breakfast was given after the two hour determination, which was four hours prior to the final determination.

TABLE 1.—*The Percentage Variations in Basal Metabolism Immediately Following, and One, Two, and Six Hours After Ultraviolet Radiations as Compared With the Basal Metabolism Prior to Treatment*

Case No.	Date	Minutes of Exposure	Percentage Variations in Basal Metabolism after Ultraviolet Radiation: 5 Min.	1 Hour	2 Hours	6 Hours	Comment
	1925						
8	Dec. 11	5	0	+ 4	+14*	+23*	
	14	7	— 7	— 3	0	Not done	
	16	10	— 2.7	+12	— 6.6	+ 8	
	18	13	— 4	+19[1]	+18[1]	Not done	[1] Marked erythema; uncomfortable
	21	13	— 7	+ 2.7	+13.7[2]	+13.7[2]	[2] Erythema; uncomfortable
	23	15	— 6	— 6	—12.7	Not done	
	1926						
9	Jan. 13	5	0	+ 7	+ 4.7	0	
	15	10	+ 2	0	0	+44.7*	
	18	10	+ 7.6	+15[3]	0	+ 7.6	[3] Child moved
	20	13	+11.6[4]	+23[4]	+11.8	+17.6[5]	[4] Stranger in room; [5] restless
	22	15	+ 8.9	0	0	+ 9	
	25	Control[6]	— 5	— 4.7	+ 5	+ 2.6	[6] Exposed to closed lamp 15 min.
	1926						
10	Feb. 24	5	0	— 8			
	26	7	— 2	+ 6	— 7.6	+ 8	
	March 1	7	+ 2	+ 6	+15[7]	+ 9	[7] Since there was a rise of 17% during control period, only a rise over 17% can be attributed to ultraviolet radiation
	3	9	— 1	+ 2	— 3	+10	
	6	12	— 3	+13[7]	+13.6[7]	+13.6[7]	
	8	Control[8]	+12	+17[7]	+ 7	+ 6	
	10	15	— 0.9	— 3.5	+ 6	+ 8	[8] Exposed to closed lamp 15 min.
	1926						
11	May 7	3	+32*	+10	+ 7.8	+44[9]	[9] Party in ward; excited, got out of bed before last determination
	11	6	0	0	0	+ 8	
	13	9	— 8	0	— 8	— 8	
	15	12	0	0	+ 7.8	+ 7.3	
	18	15	0	0	— 0.9	—13	
	20	Control[10]	— 2	+ 2	+ 2	+ 3	[10] Exposed to closed lamp 15 min.
	1926						
12	June 11	3	+ 4	— 8	+ 7	Not done	
	15	Control[11]	— 0.6	— 1.5	+ 7	+ 7	[11] Exposed to closed lamp 6 min.
	17	6	— 5	— 3	— 8	0	
	19	9	0	+ 7	0	+14[12]	[12] Child coughed
	23	12	0	— 8	0	+ 7.3	
	25	15	— 4.7	— 4.7	+ 1	— 2.7	

* Tracing showed air leak through mouth-piece which was not held tightly enough.

On the control day the same procedure was followed, except that the hood of the lamp remained closed, so that while the child was going through the habitual form, he was actually not receiving any radiations but was unconscious of any change in procedure.

The blood pressure and the pulse rate were also noted each time the basal metabolism was determined. This was done as a check on the metabolism reading, as it has been found by many workers that there is a direct relationship between the individual pulse rate and the indi-

TABLE 2.—*Observation in Case 8 Before and After Ultraviolet Radiations* *

Date	Weight in Kg.	Ultraviolet Radiations: Distance in Inches	Ultraviolet Radiations: Time in Minutes	Before: Total Calories per Hour	Before: Pulse	Before: Blood Pressure	5 Minutes After: Total Calories per Hour	5 Minutes After: Pulse	5 Minutes After: Blood Pressure	1 Hour After: Total Calories per Hour	1 Hour After: Pulse	1 Hour After: Blood Pressure	2 Hours After: Total Calories per Hour	2 Hours After: Pulse	2 Hours After: Blood Pressure	6 Hours After: Total Calories per Hour	6 Hours After: Pulse	6 Hours After: Blood Pressure	Comment
12/11/25	29.8	20	5	36.2	62	84/40	36.2	62	84/32	37.1	62	.....	41.4†	56	86/26	44.8†	54	82/38	
12/14/25	30.0	20	7	36.1	63	80/30	33.5	59	90/44	34.8	58	80/40	36.1	58	84/32	Not done			Itching in afternoon
12/16/25	30.0	20	10	36.1	63	82/40	35.1	56	82/34	40.5	59	80/40	33.7	57	85/30	39.2	54	102/50	Desquamation, erythema in afternoon
12/18/25	30.1	20	13	34.1	60	80/30	32.6	58	80/30	40.7[1]	61	74/32	40.5[1]	58	72/32	Not done			[1] Marked erythema; uncomfortable
12/21/25	30.1	20	13	36.5	58	76/36	33.8	58	.....	37.5	60	...	41.5[2]	58	.....	41.5[2]	58	72/32	[2] Marked erythema; uncomfortable
12/23/25	30.2	20	15	42.4	62	78/30	39.7	65	80/34	39.7	57	88/32	33.9	61	86/28	Not done			Pigmentation

* The patient was a girl, aged 12; sitting height, 75 cm.; total height, 141 cm.; complexion, brunette; diagnosis, condition following grip. The patient refused agar-jelly; did not receive any food during experiment; received water. Control period preceded experimental period. Diet since 12/3/25, 1,875 calories, about 10 per cent protein.

† Tracing showed entrance of air through mouth-piece not held tightly enough.

TABLE 3.—*Observations in Case 9 Before and After Ultraviolet Radiations**

Date	Weight in Kg.	Ultraviolet Radiations: Distance in Inches	Ultraviolet Radiations: Time in Minutes	Before: Total Calories per Hour	Before: Pulse	Before: Blood Pressure	5 Minutes After: Total Calories per Hour	5 Minutes After: Pulse	5 Minutes After: Blood Pressure	1 Hour After: Total Calories per Hour	1 Hour After: Pulse	1 Hour After: Blood Pressure	2 Hours After: Total Calories per Hour	2 Hours After: Pulse	2 Hours After: Blood Pressure	6 Hours After: Total Calories per Hour	6 Hours After: Pulse	6 Hours After: Blood Pressure	Comment
1/ 8/26	22.1	..	..	28.1	87														
1/11/26	21.6	..	..	28.9	83														
1/12/26	21.6	..	..	28.9	76	.....	....	..	.....	....	..	.....	....	..	.....	....	..	.....	Last day of control period
1/13/26	21.8	20	5	34.0	74	80/32	34.0	75	82/32	36.5	78	80/32	35.7	73	.....	34.1	79	80/28	
1/15/26	22.4	20	10	34.1	83	79/30	34.9	83	90/34	33.8	86	86/40	33.8	84	80/30	49.4†	87	82/36	Itching; marked erythema
1/18/26	22.6	20	10	31.2	92	84/34	33.6	95	82/36	36.5[1]	83	82/30	31.2	92	80/34	33.6	72		[1] Child moved; slight pigmentation
1/20/26	23.0	20	13	28.8	88	88/44	32.2	86	98/44	35.5[2]	82	**80/34**	32.2	82	82/40	33.9[3]	89	84/40	[2] Stranger present [3] Restless Pigmentation; erythema
1/22/26	23.3	20	15	31.2	90	88/42	33.9	97	90/48	31.2	78	80/32	31.2	79	86/38	34.0	86	90/40	
1/25/26	23.3	Control[4]		33.7	83	84/38	32.0	84	84/38	32.1	83	81/40	35.4	85	80/25	34.6	96		[4] Exposed 15 min. to closed lamp

* The patient was a girl, aged 8; sitting height, 67 cm.; total height, 120 cm.(?); diagnosis, postrheumatic fever. During the experiment the child received 6 ounces of water with saccharin after a determination immediately following treatment; diet to 1/8/26, 1,500 calories, since then 1,800 calories, about 10 per cent protein. A light breakfast of 100 cc. milk and 20 Gm. of Uneeda biscuits was given after 2 hour determination.

† Tracing showed entrance of air through mouth-piece not held tightly enough.

TABLE 4.—*Observations in Case 10 Before and After Ultraviolet Radiations**

Date	Weight in Kg.	Ultraviolet Radiations: Distance in Inches	Ultraviolet Radiations: Time in Minutes	Before: Total Calories per Hour	Before: Pulse	Before: Blood Pressure	5 Minutes After: Total Calories per Hour	5 Minutes After: Pulse	5 Minutes After: Blood Pressure	1 Hour After: Total Calories per Hour	1 Hour After: Pulse	1 Hour After: Blood Pressure	2 Hours After: Total Calories per Hour	2 Hours After: Pulse	2 Hours After: Blood Pressure	6 Hours After: Total Calories per Hour	6 Hours After: Pulse	6 Hours After: Blood Pressure	Comment
2/19/26	22.0?	..	..	33.5	78														
2/20/26	....	..	..	31.1	62	84/40													
2/23/26	....	..	..	26.2 28.3[1]	..	.....	....	..	.....	....	..	.....	....	..	.....	....	..	.....	[1] Four hours after light breakfast Last day of control period
2/24/26	....	20	5	29.0	63	82/34	29.3	60	80/26	26.6	62	80/28	Not done[2]			Not done[2]			[2] Ate lunch by mistake after 1 hour test; immediate erythema
2/26/26	....	20	7	28.8	64		28.2	62	80.30	30.7	64	80/30	26.6	58	78/40	31.2	60		
3/ 1/26	....	20	7	29.4	66		30.1	66		31.2	66		33.8	72		32.2	66		Moderate erythema
3/ 3/26	....	20	9	29.3	64		29.0	64		30.0	68		28.2	64		32.5	64		Slight erythema; some pigmentation
3/ 6/26	....	20	12	30.0	66	84/38	28.9	65	82/32	33.9[3]	66	70/30	34.1[3]	80	90/34	34.1[3]	63	88/40	[3] Used strange room; child excited; slight desquamation
3/ 8/26	....	Control[4]		29.7	68	86/34	33.4	66	86/32	36.1	72	86/32	32.1	70	.....	31.6	74	84/34	[4] Exposed 15 min. to closed lamp
3/10/26	....	20	15	31.2	73	80/34	30.9	68	.....	30.1	62	80/.38	33.2	73	80/34	33.9	76	90/40	Pigmentation, some desquamation

* The patient was a girl, aged 8; sitting height, 67 cm. (?); total height, 125 cm.; complexion, brunette; diagnosis, postpneumonic condition. The patient was placed on a diet of 1,800 calories, about 10 per cent protein; a light breakfast of 100 cc. of milk and 20 Gm. of Uneeda biscuits was given after 2 hour determination.

vidual level of basal metabolism. Some of these workers, among whom may be mentioned Benedict,[5] Pirquet,[6] Read,[7] and Schick and Cohen,[8] even go so far as to say that it is usually possible to draw conclusions about the level of the basal metabolism from the pulse rate of a person.

Table 1 records the details in each case. Results are expressed in percentage of increase or decrease over the morning determination prior to radiation, rather than in terms of body weight or surface area, as it was the purpose of this study to determine whether ultraviolet radiations caused any increase or decrease after varying intervals of time. Tables 2 to 6 give the data for all determinations.

RESULTS

Table 1 shows how slight the variations in basal metabolism were following the treatment with light. Cases 11 and 12 do not show any variations greater than a plus or minus 10 per cent, except in four instances, one of which is traceable to an air leak through the mouthpiece, which was not held tightly enough. The only great rise in metabolism is in case 11, and this followed the excitement of a party. Cases 8, 9 and 10 show several changes greater than 10 per cent. These variations, however, are inconstant. They do not show any regularity in relation to time following irradiations; nor did they ever occur without a concomitant emotional disturbance produced by a definite environmental condition. Uncontrollable factors, such as excitement at the prospect of going home, a party in the ward, an unexpected change in the metabolism room, or physical discomfort caused by erythema and itching, could not be avoided, and undoubtedly influenced the determinations of metabolism. Grafe and his associates[9] believe that emotion may cause a distinct increase in metabolism, and it seems justifiable, therefore, to consider that the few instances of increased metabolism in these children were due to emotion, rather than to ultraviolet radiations.

There were not any appreciable changes in blood pressure or in pulse rate. This would substantiate the observations on basal metabolism. In most instances in which there was an appreciable rise in metabolic rate due to emotional causes, an increase in pulse rate was

5. Harris, J. A., and Benedict, F. G.: Biometric Study of Basal Metabolism in Man, Carnegie Inst., Washington Pub. 279, 1918.

6. Pirquet, C.: Pulsfrequenz und Sitzhöhe, Ztschr. f. Kinderh. **38**:301, 1924.

7. Read, J. M.: Correlation of Basal Metabolism with Pulse Rate and Pulse Pressure, J. A. M. A. **78**:1887 (June 17) 1922.

8. Schick, B., and Cohen, Philip: Lowered Basal Metabolism, Am. J. Dis. Child. **30**:291 (Sept.) 1925.

9. Grafe and Traumann: Ztschr. f. d. ges. Neurol. u. Psychiat. **62**:237, 1920. Grafe and Mayer: Ibid. **86**:247, 1923.

TABLE 5.—*Observations in Case 11 Before and After Ultraviolet Radiations**

Date	Weight in Kg.	Ultraviolet Radiations: Distance in Inches	Ultraviolet Radiations: Time in Minutes	Before: Total Calories per Hour	Before: Pulse	Before: Blood Pressure	5 Minutes After: Total Calories per Hour	5 Minutes After: Pulse	5 Minutes After: Blood Pressure	1 Hour After: Total Calories per Hour	1 Hour After: Pulse	1 Hour After: Blood Pressure	2 Hours After: Total Calories per Hour	2 Hours After: Pulse	2 Hours After: Blood Pressure	6 Hours After: Total Calories per Hour	6 Hours After: Pulse	6 Hours After: Blood Pressure	Comment
4/22/26	23.5	..	..	31.0															
4/26/26	23.3	..	..	30.2	66														
4/28/26	23.6	..	..	31.7															
4/30/26	23.3	..	..	36.0[1]	..	....	.....	..	.....	....	..	.....	....	..	.....	....	..	.....	[1] Four hours after light breakfast
5/ 4/26	23.9	..	..	33.6[2]	62	.....	....	..	.....	....	..	.....	....	..	.....	....	..	.....	[2] Four hours after light breakfast, last day of control period
				35.5[2]	62														
5/ 7/26	23.5	20	3	31.3	66	86/50	41.5†[3]	66[3]	86/52	34.7	61	84/52	33.8	60	90/44	45.3[4]	80[4]	80/42	[3] Air leak; note slow pulse Skin itched
5/11/26	23.3	20	6	31.0	60		31.0	60		31.1	60		31.0	60		33.8	63		[4] Excited; out of bed; party; note rapid pulse
5/12/26	23.5	..	..	33.4[5]	57	80/50	....			....			....			....			[5] Four hours after light breakfast, slight desquamation
5/13/26	23.5	20	9	33.8	60	80/50	31.0	60	80/48	33.8	64	80/50	31.0	66		31.0	62		Slight pigmentation, fine desquamation
5/15/26	23.5	20	12	31.2	60	74/30	31.2	60	78/36	30.9	60	76/50	33.8	63	76/50	33.5	63	76/50	Pigmentation, desquamation; erythema in afternoon
5/18/26	23.6	20	15	41.6†	65	80/48	41.6	72	78/44	41.4	70	74/34	41.2	70	74/34	35.8	70	84/32	
5/20/26	23.6	Control[6]		44.5†	70	76/38	32.5	70	76/38	33.9	70	76/38	33.9	70	76/38	34.3	70	76/38	[6] Exposed 15 min. to closed lamp

* The patient was a girl, aged 9; sitting height, 68 cm.; total height, 128.5 cm.; complexion, brunette; diagnosis, healthy child with poor appetite. The patient was placed on a diet of 1,850 calories, about 10 per cent protein; a light breakfast of 100 cc. milk and 20 Gm. Uneeda biscuits was given after 2 hour determination.

† Tracing showed air leak through mouth-piece; therefore average basal metabolic rate was used in figuring percentage.

TABLE 6.—*Observations in Case 12 Before and After Ultraviolet Radiations**

Date	Weight in Kg.	Ultraviolet Radiations: Distance in Inches	Ultraviolet Radiations: Time in Minutes	Before: Total Calories per Hour	Before: Pulse	Before: Blood Pressure	5 Minutes After: Total Calories per Hour	5 Minutes After: Pulse	5 Minutes After: Blood Pressure	1 Hour After: Total Calories per Hour	1 Hour After: Pulse	1 Hour After: Blood Pressure	2 Hours After: Total Calories per Hour	2 Hours After: Pulse	2 Hours After: Blood Pressure	6 Hours After: Total Calories per Hour	6 Hours After: Pulse	6 Hours After: Blood Pressure	Comment
6/11/26	23.3	20	3	34.1	76	94/52	35.6	72	.....	31.2	76	92/54	36.7	76	94/54	Not done			
6/15/26	22.4	Control[1]		33.7	78		33.5	80		33.2	80		36.1	76		36.1			[1] Exposed 5 min. to closed lamp
6/17/26	22.4	20	6	34.4	68	90/54	32.7	72	.....	33.2	72	.....	31.7	66	.....	34.3	74	90/50	Slight erythema in afternoon
6/19/26	22.6	20	9	31.6	78	82/36	31.6	69	84/40	31.8	67	84/40	31.6	68	86/48	36.1[2]	75	86/40	[2] Child coughed; slight erythema; fine desquamation
6/23/26	22.6	20	12	33.9	78	90/54	33.9	78	88/54	31.2	72	90/54	33.8	82	90/54	36.4	85	90/54	
6/25/26	22.7	20	15	36.0	80	88/50	34.8	80		34.4	80		36.4	80		35.0	78		

* The patient was a boy, aged 10; sitting height, 63 cm.; total height, 129 cm.; complexion, brunette; diagnosis, healthy child with poor appetite. The patient was placed on a diet from May 25 to June 4 of 1,300 calories, about 10 per cent protein; from June 4 to June 22, 1,600 calories; since June 22, the diet was increased through an error to 1,800 calories, about 10 per cent protein. The control period preceded the experimental period. A light breakfast of 100 cc. milk and 20 Gm. Uneeda biscuits was given after 2 hour determination.

also noted. When, however, the increase in metabolism was traceable to an air leak, a change in pulse rate did not occur. This is in accordance with the observations of those workers who trace a definite relation between pulse rate and metabolic rate.

SUMMARY

1. Five children were treated with ultraviolet radiations three times a week, the length of exposure being gradually increased from three minutes to fifteen minutes.

2. Determinations of basal metabolism were made preceding and immediately following irradiations, and again one, two and six hours later.

3. The basal metabolism preceding and following irradiation usually did not vary more than 10 per cent. In all cases in which the increase was greater than 10 per cent, there was a disturbing environmental factor which, in itself, could have explained the increase.

4. The blood pressure and the pulse rate remained practically constant throughout.

CONCLUSIONS

Therapeutic doses of ultraviolet radiation did not cause any appreciable change in basal metabolism, nor any change in the blood pressure or pulse rate of these children either immediately after treatment or one, two or six hours later. In all probability, therefore, it can be assumed that there will not be any change in basal metabolism, pulse rate or blood pressure in the majority of children following therapeutic doses of ultraviolet light.

ENLARGEMENT OF THE SPLEEN IN CHILDREN *

ADRIEN BLEYER, M.D.

ST. LOUIS

In attempting to get an idea of the frequency of enlarged spleen in children, it was necessary to keep in mind that the spleen is subject to change in size as well as in position and that a great many things may contribute to this. Some of these causes are transitory and even appear to be physiologic; for instance, the swelling of the spleen that follows a heavy meal or a transfusion of blood.[1] Again, the spleen may be pushed about and may give the impression of enlargement, as by a narrowed thorax in rickets or by fluid in the pleura, or it may be displaced upward and escape detection because of distention of the abdomen by gas or by fluid; it may be impossible to feel the spleen because of muscle rigidity or the resistance of the child. However, an interesting fact is that enlargement of the spleen appears to be related to the infectious diseases and in some of them is commonly used in diagnosis, while in others its behavior has been so inconsistent as to lead to considerable uncertainty.

Charts 1 and 2 show the observation made last year as to the behavior of the spleen in measles; it was found to be enlarged in about half the cases.[2]

Chart 3 represents the occurrence of enlarged spleens in a number of the common diseases of children and was constructed for comparison with charts 1 and 2. In this group, composed of 1,000 children, it was noted that in scarlet fever, diphtheria, rubella and the other diseases listed the reaction on the part of the spleen was not pronounced and never occurred often enough to be of any particular diagnostic help. In pneumonia and also in chickenpox, the percentage rose to slightly above 20. Among these children there were 120 with measles, and they showed enlarged spleens in 47 per cent, which corresponds fairly well with last year's charts.

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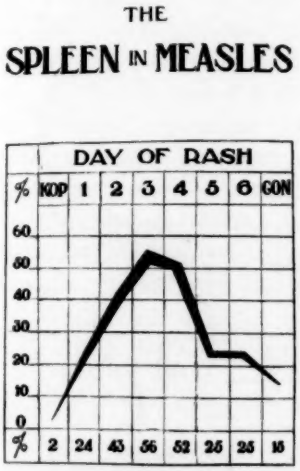
* From the Department of Pediatrics, Washington University School of Medicine and the St. Louis Children's Hospital.

* Presented at a meeting of the Central States Pediatric Society, October 22, and read before the St. Louis Medical Society, Nov. 23, 1926.

1. Vollmer, H., and Serebrijski, J.: Blood Transfusion and the Spleen, Ztschr. f. d. ges. exper. Med. **50**:621 (May 25) 1926.

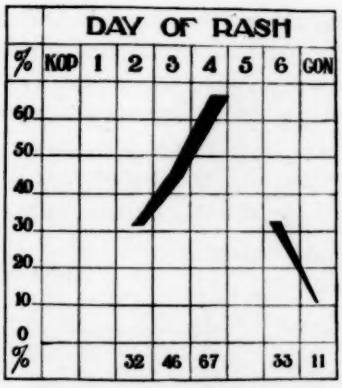
2. Bleyer, Adrien: Enlargement of the Spleen in Measles, Am. J. Dis. Child. **31**:26 (Jan.) 1926.

In active inherited syphilis, the spleen was found enlarged in twenty-seven of twenty-eight cases, illustrating the great diagnostic value of enlarged spleen in this disease; that is, active inherited syphilis may practically be ruled out in a young child if it can be satisfactorily shown that the spleen is not enlarged. On the other hand, however, one



FIRST SERIES

Chart 1



SECOND SERIES

Chart 2

Chart 1.—Enlargement of the spleen in measles, based on the examination in 264 cases.

Chart 2.—Enlargement of the spleen in measles, based on 133 cases.

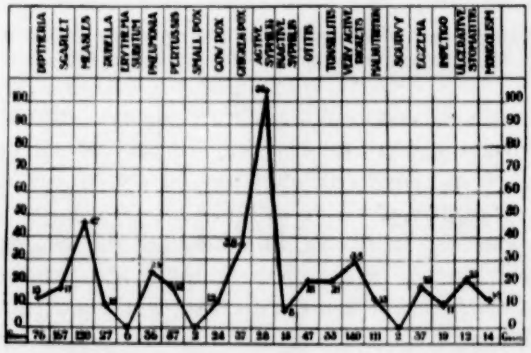


Chart 3.—The occurrence of enlargement of the spleen in the common diseases of 1,000 children.

encounters frequent statements in the literature of the importance to be attached to an enlarged spleen in an infant, as indicative of syphilis; one syphilographer of note, for example, stated that in his experience, 70 per cent of infants under 3 months of age with enlarged spleens have syphilis.

This question of the spleen in syphilis was one of several interesting points concerning which there is confusion in the literature, and which we endeavored to check by the examination of a large group of apparently healthy infants. Almost 1,700 such infants were examined, of whom 1,263 were in the first year of life. In this younger group, the spleen was palpable in 191. Seven hundred and fifty-seven of these infants were under 3 months, and among them the spleen was found enlarged in eighty-one. None of these infants with enlarged spleens showed clinical syphilis, and Wassermann tests made on a group of twenty-one of them selected at random were negative in every instance.

Another point of interest was the occurrence of enlarged spleens in rickets, in which, contrary to statements repeated in one textbook after another, the spleen was rarely enlarged unless rickets was pronounced. Rickets, it seems, must be active or advanced to influence the size of the spleen. Again, malnutrition, which in a leading textbook on

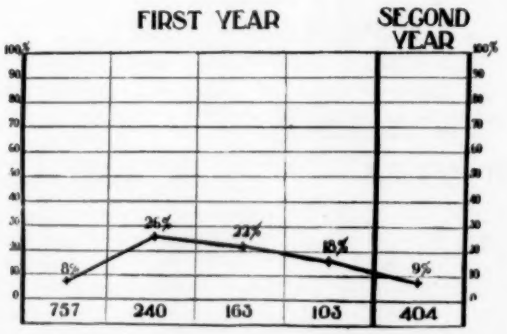


Chart 4.—Enlargement of the spleen in infancy. One thousand two hundred and sixty-three infants were examined in the first year, 404 in the second.

physical diagnosis is ascribed a place of highest importance next to leukemia and rickets, was found in only 13 per cent of the cases; this figure is too low to give to malnutrition a place of any importance in the origin of enlargement of the spleen.

It was interesting, moreover, in examining the infants to note the extraordinary frequency of enlargement of the spleen through the middle months of the first year and the decrease in the percentages at either end of the first year. This is shown in chart 4, with 26 per cent of enlarged spleens in the second quarter. In the second year, palpable spleens occurred thirty-six times among 404 infants, which is 9 per cent or about half the frequency noted in the first year.

CONCLUSIONS

1. In three groups of cases of measles, comprising more than 500 cases, the spleen was found to be enlarged in 56 per cent. The appear-

ance of the spleen at the height of the rash and its abrupt disappearance indicate that this reaction is related to the virus of this disease.

2. No such reaction as was observed in measles occurred in the other common diseases of children.

3. Active rickets shows enlarged spleens in about one case in three. This is not due, however, to an accompanying malnutrition. Mild rickets shows no reaction as to the size of the spleen.

4. Inherited syphilis when active is characterized by enlargement of the spleen.

5. Syphilis is, however, an uncommon cause of enlargement of the spleen in early life.

6. Enlargement of the spleen is common among apparently healthy infants and is thus of little diagnostic help at this time. This is particularly true during the middle months of the first year of life, when it may be observed in about one case in four. In the second year, it is about half as common as in the first year.

PYLORIC STENOSIS OF INFANTS*

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At the present time, there is considerable divergence of opinion as to whether infants with congenital hypertrophic pyloric stenosis should be treated medically or surgically. Certain authors believe that all infants should be treated medically; others, that medical treatment should first be tried and that if it is unsuccessful, surgical methods should be employed; while on the other hand, some observers believe that all infants should be submitted to operation as soon as the diagnosis has been made.

DIAGNOSIS

Before this question can be discussed intelligently, the diagnosis must be considered briefly. The cardinal symptoms and signs are: (1) projectile vomiting; (2) visible gastric peristalsis; (3) palpable pyloric tumor, and (4) constipation with a small amount of material in the stool. The patients usually present a fulness in the upper part of the abdomen as contrasted with the portion below the umbilicus. If the constriction of the pylorus is marked and of some duration, the infant is emaciated and the amount of urine passed is small.

A careful survey of the literature shows that many observers have included, under the diagnosis of pyloric stenosis, infants suffering from hypertonia or pylorospasm. Certain authorities consider pylorospasm to be simply a stage in the production of pyloric stenosis. We, however, believe that pylorospasm, or hypertonia, is a distinct clinical entity that can be recognized and distinguished from pyloric stenosis. Furthermore, we believe that entirely different treatment is indicated in the two conditions, and that therefore these diseases should be carefully differentiated from each other.

The hypertonic infant is usually restless and irritable and cries a great deal of the time. There is frequent vomiting, which may become even projectile in type when there is marked spasm of the pylorus. Visible gastric peristalsis may be present but is never so pronounced as is frequently seen with pyloric stenosis. Although constipation may be present, the stools are almost invariably larger than with pyloric stenosis. No tumor of the pylorus can be felt. In addition, the hypertonic infant

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* From the Hospital for Sick Children.

presents an increased tone of the skeletal muscles. This can usually be demonstrated by lifting the infant by the wrists. With the normal infant the arms become fully extended, while with the hypertonic infant they remain flexed. The same is true of the legs if the infant is lifted by the ankles.

Some observers [1] believe that visible gastric peristalsis is the most important single sign on which to base the diagnosis of pyloric stenosis. Strauss [2] bases his diagnosis largely on a special fluoroscopic examination: "A small amount of barium is added to breast milk which the infant is given while he is being observed under the fluoroscope. The rhythmic, snake-like, peristaltic contractions seen in the pylorus, independent of the contractions of the rest of the stomach, are absolutely pathognomonic of the condition. . . . When 80 per cent or more of the food passes through the pylorus in four hours, although characteristic contraction waves are present, operation is deferred. These latter cases are treated medically and the result of treatment is frequently favorable." The most reliable single sign, however, in the diagnosis of pyloric stenosis is a palpable tumor. We believe that this can be felt in practically every case if sufficient care and time are taken in the examination. In our whole series of 120 cases, the tumor was felt in more than 92 per cent of the patients, while in the last fifty-two cases it was felt in every instance. Still [3] failed to palpate the tumor in only two of 248 patients. In Bolling's [4] 454 cases, the tumor was palpated in all but one. Poynton, Higgins and Brydson [5] failed to feel the tumor in only one of their fifty-five patients. On the other hand, in Davison's [6] sixty cases, the tumor was palpated in only 63 per cent, and in Abt and Strauss' [2] series of 221 cases the tumor was felt in only 25 per cent. The obvious explanation of these divergent results is that either the three last mentioned observers have included in their series conditions other than pyloric stenosis, or that they did not direct sufficient care and attention to the observation of this sign.

TREATMENT

The treatment of pyloric stenosis may be either medical or surgical. To be strictly correct, the so-called surgical treatment should be considered as a combination of both medical and surgical treatments, because the success of the operation depends to a large measure on the medical postoperative care. In poorly nourished infants, the preopera-

1. Findlay, L.: Brit. J. Dis. Child. **20**:1, 1923.
2. Abt, I. A., and Strauss, A. A.: M. Clin. N. Amer. **9**:1305, 1926.
3. Still, G. F.: Brit. M. J. **1**:579 (April 7) 1923.
4. Bolling, R. W.: Congenital Hypertrophic Pyloric Stenosis, J. A. M. A. **85**:20 (July 4) 1925.
5. Poynton, F. J.; Higgins, T. T., and Brydson, J. M.: Lancet **1**:215 (Feb. 2) 1924.
6. Davison, W. C.: Bull. Johns Hopkins Hosp. **37**:75, 1925.

tive care is also of paramount importance. It is thus evident that the success of operative treatment depends to a large measure on the degree of cooperation between the medical and surgical services. If this is lacking, the results will be disastrous.

The Rammstedt operation,[7] or some modification of it,[2] is used almost exclusively. Many hundreds of infants with pyloric stenosis have now been treated in this manner since the introduction of the operation in 1912. The most recent report of a large series of cases is that recorded by Abt and Strauss,[2] who operated on 221 infants, with a mortality of 3.1 per cent. Bolling,[4] in 1925, also reported 454 cases (175 of these had already been reported by Downes [8]), with a mortality of 14.7 per cent. Mixter,[9] in discussing Bolling's paper, reported 195 cases from Boston, with a mortality of 9.5 per cent. From Germany, Borchard [10] reported 301 cases, with a mortality of 16.3 per cent. The mortality in the cases in which operation was done in Great Britain is much higher, due possibly to delayed operation and lack of close cooperation between medical and surgical services. Gray and Reynolds,[11] in 1921, reported thirty-eight cases, with a mortality of 55 per cent. Ashby and Southam,[12] in 1923, reported that the operative mortality for fifty-five cases at the Hospital for Sick Children, Great Ormond Street, London, was 29 per cent. Findlay [1] of Glasgow in 1923 reported a mortality of 66 per cent in eighteen surgically treated patients, and Parsons [13] of Manchester, in 1924, a mortality of 45.8 per cent in seventy surgically treated patients.

Three main methods have been employed in the medical treatment of pyloric stenosis. The first is the refeeding of the infant after it has vomited. It has been observed by Findlay,[1] Gerstley and Wilhelmi,[14] Davison [15] and others that infants who have vomited will frequently retain a second feeding if it is given immediately after the vomiting. Davison states: "The fact that in many cases of pyloric stenosis a palpable tumor can only be palpated immediately after a peristaltic wave would seem to indicate that the hypertrophied pylorus is relaxed between gastric contractions. Because of this fact . . . feeding and refeeding of woman's milk is frequently successful. If food is administered persistently, eventually some of it may pass the hypertrophied pylorus

7. Rammstedt, C.: Med. klin. **8**:1702, 1912.
8. Downes, W. A.: Congenital Hypertrophic Pyloric Stenosis, J. A. M. A. **75**:228 (July 24) 1920.
9. Mixter, C. G., in discussion on Bolling (footnote 4).
10. Borchard, M.: Med. klin. **18**:651, 1922.
11. Gray, H. T., and Reynolds, F. N.: Brit. M. J. **2**:891 (Nov. 26) 1921.
12. Ashby, H. T., and Southam, A. H.: Brit. M. J. **1**:403 (Feb. 28) 1925.
13. Parsons, L. G.: Proc. Roy. Soc. Med. (Sect. Dis. Child.) **18**:29 (Dec.) 1924.
14. Gerstley, J. K., and Wilhelmi, L. J.: M. Clin. N. Amer. **8**:587, 1924.
15. Davison, W. C.: Bull. Johns Hopkins Hosp. **37**:157, 1925.

during one of its periods of partial relaxation and in this way the patient's nutrition may be maintained until the growth of the digestive tube compensates for the hypertrophy of the pylorus." There is no doubt that satisfactory results are obtained in a large percentage of cases by this method. The disadvantages are that a large amount of woman's milk is required, which is frequently difficult to obtain, and in addition that a long stay in the hospital is necessary, during which time the patient is in constant danger of acquiring some parenteral infection, with disastrous results.

The second method of medical treatment is the administration of atropine sulphate just before each feeding. The most ardent advocate of this method is Haas,[16] who believes that pyloric stenosis is simply an advanced degree of pylorospasm. He concludes that "Most if not all cases can be cured by sufficient doses of atropine correctly administered." He starts with 1 drop of a fresh 1:1,000 solution of atropine sulphate with each feeding and increases the dose 1 drop with each feeding or with each alternate feeding until vomiting ceases or physiologic effects are produced. Beneficial effects have also been reported by Ibrahim,[17] Johannessen [18] and others. Our results in the treatment of pyloric stenosis with atropine have been disappointing, although in certain cases of pylorospasm or hypertonia the effect has been spectacular. Other observers have not been impressed with the value of atropine.[19]

The third method of medical treatment is the use of a thick cereal feeding, advocated by Sauer.[20] This feeding is prepared by boiling cooked cereal with milk, water and if necessary sugar, until the mixture is of a thick consistency and barely drops off the inverted spoon. This feeding is then given to the infant by placing small portions on the end of a tongue depressor and scraping it off onto the back of the tongue by means of another tongue depressor. Sauer found this method effective in twenty-eight of his thirty-five cases. Porter [21] reports ten patients treated in this manner with no mortality. There is no doubt that the use of thick cereal feedings either alone or combined with atropine is of value in combating vomiting due to many causes, including pylorospasm and certain cases of pyloric stenosis. On the other hand, we have observed a great number of cases of pyloric stenosis in which the use

16. Haas, S. V.: Congenital Hypertrophic Pyloric Stenosis and Its Treatment by Atropine, J. A. M. A. **79**:1314 (Oct. 14) 1922.

17. Ibrahim, J.: Ergebn. d. inn. Med. u. Kinderh. **24**:233, 1923.

18. Johannessen, A.: Ugeskr. f. Læger **86**:113 (Feb. 7) 1924; abstr. J. A. M. A. **82**:932 (March 15) 1924.

19. Footnotes 13 and 14. Kerley, C. G.: The Practice of Pediatrics, ed. 3, Philadelphia, W. B. Saunders Co., 1924, p. 218.

20. Sauer, L. W.: Pyloric Stenosis: Am. J. Dis. Child. **22**:166 (Aug.) 1921.

21. Porter, L.: Arch. Pediat. **36**:385, 1919.

of the thick cereal feeding in the period between admission to the hospital and the operation gave disappointing results.

Our series of patients with pyloric stenosis consists of 120 patients admitted consecutively to the Hospital for Sick Children, Toronto, from 1919 to August, 1925. In every instance the Rammstedt operation was performed, with a mortality for the whole series of 13.2 per cent. The diagnosis of pyloric stenosis was confirmed in every instance at operation.

SYMPTOMS AND SIGNS

The frequency with which each of the four cardinal symptoms and signs was encountered is given in the accompanying table. As stated before, the pyloric tumor was palpated in more than 92 per cent of the cases, and we now consider that it can be felt in practically every case of true pyloric stenosis if sufficient time is given to the examination. True, it may be necessary to examine the patient repeatedly, as it is a common experience to feel the tumor with the greatest of ease at one

TABLE 1.—*Frequency of Four Cardinal Symptoms and Signs*

	Visible Gastric Peristalsis	Projectile Vomiting	Palpable Pyloric Tumor	Constipation
Positive observations	96	113	111	105
Negative observations	17	5	8	11
No record	7	2	1	4
Total	120	120	120	120

time and then at another time to find no evidence of it, in spite of a careful examination. It is probable that the tumor gets tucked up under the edge of the liver or in some other position in which it cannot easily be felt. It is usually easily palpated when the infant is being fed and when peristaltic waves are present. Care must be taken not to mistake a prolapsed right kidney for the tumor.

In regard to the age of onset, 11 per cent of our infants vomited from birth. Almost 85 per cent showed the first evidences of the disease after the first week of life. The onset in one third of the cases was not until after the third week. The most frequent time of onset was during the second and third weeks of life. The maximum age at onset was 70 days.

The onset was gradual in more than half of our patients. Davison [6] found that "A sudden onset is an important factor in the case fatality rate, being 25 per cent in those of sudden onset and only 3 per cent among patients whose onset was gradual." The case fatality rate in our sixty-seven cases that showed a gradual onset was 15 per cent, while in the fifty-two infants with a sudden onset the fatality rate was only 11 per cent. It is thus evident that our figures do not bear out Davison's

conclusion that the mortality is higher in infants in which the onset is sudden than in those in which it is gradual. Davison also states: "The case fatality rates were highest in these groups . . . who instead of being constipated had diarrheal or normal stools." Contrary to Davison's experience, eleven of our cases showed visible gastric peristalsis, projectile vomiting, palpable tumor, and normal or diarrheal stools, with recovery in every instance except one.

The general condition of seventy-five of our infants on admission was good or fairly good, and the mortality in this group was only 8 per cent. On the other hand, the mortality in the other forty-five patients who were admitted in a poor or a very poor condition was 22.7 per cent.

The cause of death in the sixteen fatal cases was as follows: decomposition, 5; respiratory infections, 3; moribund at time of operation, 3; decomposition and diarrhea, 1; postoperative acidosis, 1; general peritonitis, 1; volvulus, 1, and collapse, 1.

AUTHORS' METHOD OF DIAGNOSIS AND TREATMENT

The routine procedure used in this clinic in the diagnosis and treatment of pyloric stenosis is as follows:

The patient is usually given a thick feeding at four hour intervals, with or without atropine and is carefully observed for the appearance of the four cardinal symptoms and signs of the disease, namely: visible gastric peristalsis, projectile vomiting, palpable tumor and constipation. In addition, an attempt is made to determine the amount of food passing through the pylorus by aspiration of the contents of the stomach just before a number of the feedings. The patient is usually regarded as not suffering from pyloric stenosis unless a definite tumor is felt, or unless, in those occasional instances in which no tumor can be felt, the patient rapidly loses weight and has marked gastric retention and other symptoms of the disease. It is evident that many of these infants which we regard merely as difficult to feed or as hypertonic and which we treat medically might be regarded elsewhere as having pyloric stenosis. Although we have good results in the treatment of these infants, still in the course of six or seven years a certain number of them have died and in only one instance was a pyloric tumor found at autopsy. We may conclude, therefore, that we are not missing many cases of pyloric stenosis or else that we are having almost 100 per cent of recoveries with medical treatment, as contrasted with a much higher mortality from vomiting due to other causes, as seen in the routine hospital cases. This is hardly probable.

As soon as a definite diagnosis of pyloric stenosis is made, the infant is prepared for operation. If the patient is dehydrated and in poor condition, interstitial and intravenous injections of 10 per cent glucose are given. In addition, if the patient is in a very poor condition, a transfusion of blood is administered. It may be necessary to delay the operation for one or two days until the condition is improved by these means. The standard Rammstedt operation is performed. The incision is made high up, so that after the operation the liver will partly protect the wound from the dangers of hernia. The tumor is delivered through the wound and a longitudinal incision made in the bloodless area into the muscular coats. The incision is then extended by blunt dissection down to the mucous layer. The pylorus is then replaced in the abdomen and the abdominal wound closed. The operation is followed by a transfusion of 15 cc. of blood per pound of body weight in every case. It is felt that this transfusion

is a great factor in lowering the mortality rate, as many of these infants are dehydrated and in a toxic condition. The infant on its return to the ward is placed on its right side and the head of the bed elevated. Four hours after the operation ½ ounce (15 cc.) of full strength breast milk is given. The patient is then fed every four hours and the amount of breast milk increased 1 dram at each feeding. Generally on the third day the infant can be nursed by the mother for the usual fifteen minutes. Some vomiting may occur for three or four days after the operation.

COMMENT

The reader might ask why we submit all our infants having pyloric stenosis to operation as soon as a definite diagnosis is made. Sauer [22] has collected from the literature reports of 497 patients who were given dietary treatment exclusively, with a mortality of only 8.9 per cent. As mentioned before, there is little doubt that there are included with these medically treated patients many infants with pylorospasm, as some authors do not differentiate between this and pyloric stenosis. It is our custom to classify infants with pylorospasm simply as being difficult to feed and to treat them as such. Only one of these cases coming to autopsy during the past six years proved to be pyloric stenosis. We believe, therefore, that the vast majority of so-called medically treated cases of pyloric stenosis should be classified as such only when the tumor can be palpated. It is reasonable to conclude that the general mortality in the cases of true pyloric stenosis in which the treatment was medical is higher than 8.9 per cent. It is to be noted that our mortality in the seventy-five patients who were in good condition, and who as a group respond best to medical treatment, was only 8 per cent.

The duration of the stay in the hospital is much shorter with surgical than with medical treatment. The average duration of the stay in the hospital of our patients who recovered was sixteen days, as compared with fifty-three days in a recently reported group of cases in which the treatment was medical.[15]

Although many infants who are in good condition may be treated medically with success, the long hospitalization with continued exposure to parenteral infections, the additional care, the long continued anxiety for both the physician and the parents and the large amount of breast milk required—all these factors, combined with the low mortality rate of the surgically treated patients in this group (8 per cent), lead us to believe that it is advisable to submit all infants having pyloric stenosis to operation.

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22. Sauer, L. W.: Arch. Pediat. **41**:145, 1924.

INORGANIC BLOOD PHOSPHATE

STUDIES OF RATS ON RACHITIC AND NONRACHITIC DIETS*

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In connection with our studies of the antirachitic factor in cod liver oil and irradiated cholesterol, we determined the inorganic blood phosphate of rats, hoping that this information could be used, in addition to roentgenograms and histologic examination, as an aid in the diagnosis of the rachitic condition. The first determinations were made on rats about 6 months old, which had been obtained originally from Doure-Doure. At the age of from 3 to 4 weeks, they were placed on the McCollum rachitic diet 3143.[1] To the diet of one group of these rats was added 0.2 per cent of irradiated cholesterol and to another 0.2 per cent of nonirridiated cholesterol. Still another group of animals on diet 3143 was irradiated daily. The rats on the rachitic diet alone or on the rachitic diet plus nonirradiated cholesterol, developed rickets much less rapidly than young rats which we later bred in our laboratory. Eventually, however, they showed all the rachitic symptoms described by McCollum. Much to our surprise, however, the inorganic blood phosphate of our animals at this time did not show the close relationship between phosphate concentration and the rachitic condition which we had expected after studying the literature. The values found for all groups, whether rachitic or nonrachitic, fell between 3.0 and 5.75 mg., figures comparable to those which have been given for controls. These observations led us to investigate the effect of age, diet and irradiation on the inorganic blood phosphate of rats.

TECHNIC OF DRAWING BLOOD

Blood for the determination of phosphate and calcium has ordinarily been obtained from rats by anesthetizing them, or by stunning them with a blow on the head and obtaining blood from the jugular vein and carotid artery. It is usually true also that samples of blood from two or more rats have been pooled for each determination. However, studies on the inorganic blood phosphate have repeatedly shown that many factors,

* Received for publication March 22, 1927.

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1. McCollum, E. V.; Simmonds, N.; Shipley, P. G., and Park, E. A.: J. Biol. Chem. **47**:507, 1921.

such as diet,[2] age,[3] exercise[4] injury and anesthesia,[5] may cause marked changes in this constituent in a relatively short time. We also find that values for inorganic blood phosphate reported in connection with rachitic studies show a wide range between the maximum and minimum figures. Although the average figures given for the nonrachitic groups are appreciably higher than the average for the rachitic groups, the minimum figures for the nonrachitic animals may be less than values obtained for the rachitic animals.[6] Such variations indicate that the statement that the inorganic blood phosphate is low in the rachitic condition and returns to normal when that condition is cured requires some qualification.

To study the conditions that may influence the blood phosphate of the rachitic animal, it seemed essential to obtain individual samples of blood and to secure them if possible without sacrificing the animal, so that the blood phosphate of a single animal could be followed under different conditions.

A common method of drawing blood from larger animals is to take it directly from the heart. This can also be done in the case of the rat,[7] although it is somewhat more difficult. After some practice, we found that by using a needle of 21-23 bore and from ½ to ⅝ inches long, blood could be successfully drawn from the heart of an anesthetized rat with a mortality of from 10 to 15 per cent, depending on the size of the rat and the amount of blood taken. After twenty-four hours, the animals that recovered were apparently normal. Williamson and Ets[7] have observed that the anemia produced by such bleeding is most acute three days subsequent to the withdrawal of blood, and that three weeks later the hemoglobin concentration is almost normal. We have not observed any effect of this method of drawing blood on the inorganic blood phosphate except a temporary one due to injury.

The inorganic phosphate was determined by the latest Briggs' modification of the Bell and Doisy method.[8] Two cubic centimeters was necessary for one determination. It was considered important to make individual determinations on several rats of the same history rather than duplicates on a pooled sample. When less than 2 cc. was obtained from the small rats two samples were occasionally pooled or a measured

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2. Robison, R., and Soames, K. M.: Biochem. J. **19**:153, 1925.

3. Dutcher, R. A.; Creighton, M., and Rothrock, H. A.: J. Biol. Chem. **66**:401, 1925.

4. Havard, R. E., and Reay, G. A.: Biochem. J. **19**:882, 1925.

5. Martland, M., and Robison, R.: Biochem. J. **18**:765, 1924.

6. Ackerson, C. W.; Blish, M. J., and Mussehle, F. E.: J. Biol. Chem. **63**:75, 1925.

7. Williamson, C. S., and Ets, H. N.: Value of Iron in Anemia, Arch. Int. Med. **36**:333 (Sept.) 1925.

8. Briggs, A. P.: J. Biol. Chem. **59**:255, 1924.

volume of standard solution was added and correction made in the final figures. The error involved in this modification was found to be not greater than 5 per cent. Individual variations in blood phosphate of rats of the same lot were greater than that, so this error did not affect the general trend of results.

Martland and Robison [5] have noted that in the rabbit the inorganic phosphate of the blood is increased by anesthesia and by injury. Anesthesia was almost obligatory in drawing blood from rats, since otherwise

TABLE 1.—*Variations in Inorganic Blood Phosphates of Dogs under Anesthesia*

	Mg. of Inorganic Phosphate per 100 Cc. of Blood Before and During Anesthesia									
Dog No.	Before	From 5 to 7 Minutes	15 Minutes	30 Minutes	1 Hour	1½ Hours	2½ Hours	3½ Hours	5 Minutes After Death	10 Minutes After Death
				Moderately Deep Anesthesia						
1	4.00	4.22	....	6.2	...	...	...	...	....	....
				Light Anesthesia—Second Stage. One Hour Deep Anesthesia						
2	4.30	4.20	4.76	4.8	5.2	5.8	6.1	9.9	9.8	....
				Deep Anesthesia—Third Stage						
3	2.15	2.76	5.45	Dog died at end of twenty-five minutes					6.22	6.51

TABLE 2.—*Effect of Anesthesia and Injury on Inorganic Blood Phosphate of Rats*

Rat No.	Anesthesia	Time of Anesthesia	Method of Drawing Blood	Struggling and Injury	Mg. Inorganic Phosphorus in 100 Cc. Blood
66	—	.....	From heart	Slight	5.05
66	+	15 minutes light anesthesia	From heart	None	5.15
66	—	.....	One week later stunned and bled from the jugular vein and carotid artery	.....	6.3
10	+	4 minutes light anesthesia	From heart	None	4.7
10	—	.....	Three hours later stunned and bled from the jugular vein and carotid artery	.....	6.2
53	—	.....	From heart	Great	11.4
53	+	4 minutes light anesthesia	Thirty minutes later from heart	None	8.9
52	—	.....	From heart	Slight	5.3
52	+	7 minutes anesthesia	From heart	None	5.6

the animals struggled violently, causing difficulty in obtaining the blood and reducing the chances of recovery because of the excessive injury. However, we wished to satisfy ourselves to what extent anesthesia did affect blood phosphate in the rat. It seemed to us that depth and time of anesthesia were both important.

Preliminary experiments were carried out on the dog. The results are given in table 1. The dogs were in the postabsorptive state when used for the experiment.

Under light ether anesthesia, the increase in organic blood phosphate was gradual. Within from five to seven minutes there was no increase; in fifteen minutes, the increase was about 10 per cent. With moderate anesthesia, an increase of 5 per cent was observed in from five to seven minutes. Under deep anesthesia, on the other hand, the increase in blood phosphate was rapid. In one case, when the initial blood phosphate was low, it was more than doubled within fifteen minutes.

Although it is exceedingly difficult to draw blood from unanesthetized rats, we were able to do this several times. We found (rats 66 and 52, table 2) that light anesthesia for from seven to fifteen minutes increased the inorganic blood phosphate from 2 to 6 per cent. It is obvious, as shown in rats 66 and 10, that the struggling and injury involved in stunning and bleeding the animal are much greater factors in increasing blood phosphate than any degree of anesthesia necessary for drawing the blood from the heart. The effect of injury on blood phosphate is again demonstrated in the results obtained on rat 53.

When blood was taken first without anesthesia and later under anesthesia, as in rats 66 and 52, it is a question how much of the increase obtained was the result of the previous shock of drawing blood and how much was due to anesthesia. Martland and Robison [5] report an increase of 40 per cent in inorganic blood phosphate of a rabbit thirty minutes after cardiac puncture.

We were finally able to perfect our technic so that almost all samples were drawn within five minutes after starting anesthesia, and the rats frequently were recovering from the anesthesia while the blood was being drawn. Experience leads us to believe that this method of obtaining blood has less effect on inorganic blood phosphate than the other methods frequently employed.

VARIATIONS IN BLOOD PHOSPHATE WITH DIET

VALUES ON CONTROL DIET

In agreement with the work of Dutcher, Creighton and Rothrock,[3] we found the blood phosphate of young rats on a control diet to be high and to decline gradually with increasing age. The youngest rats on which we determined the blood phosphate were 6 weeks old. These gave a value of 8.6 mg. per hundred cubic centimeters of blood. During the latter part of the growth period the blood phosphate remained above 6 mg., after which it declined gradually to an average value of from 4 to 5 mg. for mature rats (table 3). Sometimes, however, as high as 6 mg. and more have been obtained for adult rats on control diets. These occasional variations we have not yet been able to explain. Such high values have been obtained with females a few days after parturition. There is always the possibility too, that the animals do not eat uniformly all constituents of a mixed diet.

We have frequently noted also that vigorous, active rats tend to have higher blood phosphate values than sluggish ones. This is also to be expected from the work reported by Havard and Reay [4] on the effect of exercise on this constituent.

We have observed similar variations in the inorganic blood phosphate of dogs. One apparently normal animal in the postabsorptive state gave a value of 2.15 mg., whereas the usual values are from 5.0 to 6.5 mg. That the inorganic blood phosphate changes rapidly after ingestion of food is shown by the following observations: One and one-half hours after 400 Gm. of meat was eaten the inorganic blood phosphate rose from 5.5 to 8.6 mg., and at the end of four hours was still 8.1 mg. In another instance, after a meal of bread, milk and sugar, the phosphate was lowered from 6.5 to 5.3 mg. We also found that the postabsorptive

TABLE 3.—*Inorganic Blood Phosphate of Rats on a Control Diet*

Rat No.	Age, Weeks	Diet	Phosphorus	Calcium
470	6½	Control	8.6	.....
470	8	Control	6.25	.....
480	10½	Control	6.7	.....
490	15	Control	6.7	.....
495	19	Control	6.3	.....
460	19	Control	5.7	.....
473	19	Control	5.7	.....
370	20	Control	5.3	.....
371	20	Control	6.2	.....
5	32	Control	4.22	.....
328	38	Control	4.1	.....
115	44	Control	4.9	10.48
			Calcium × phosphorus = 51.35	
43	46	Control	4.7	.....
103	46	Control	4.5	12.49
			Calcium × phosphorus = 56.2	

values were lower after a previous diet of dog biscuit or bread and milk than after a diet of meat.

Inorganic phosphate is apparently one of the variable constituents of the blood and changes to an appreciable degree in a short period of time with diet, exercise, rest and possibly other factors.

VALUES ON RACHITIC DIET

The McCollum rachitic diet 3143 lowered the inorganic blood phosphate of mature rats from 4.2 to 1.8 mg. after about three weeks of feeding (rats 5 and 300, table 4), and of young rats from 8 to 10 weeks of age from 6.25 to 2.3 and 2.46 mg. in a similar period (rats 364, 365 and 368, table 5). This is about the same percentage lowering for adult and young rats. We have taken roentgenograms of these rats at this stage, and in addition have prepared bone sections. The bones of the mature rats have shown no change on this diet in spite of the low blood phosphate. Examination of roentgenograms and bone sections of young rats on the rachitic diet disclosed the typical widened cartilage area.

EFFECT ON BLOOD PHOSPHATE OF CURATIVE MEASURES

Irradiation.—A Cooper-Hewitt Quartz Uviarc Laboratory Outfit was used in this work. All animals were irradiated at a distance of 3 feet for two minutes daily.

Irradiation of the mature rat while on diet 3143 maintained the blood phosphate at a higher level than was the case in the nonirradiated animals, although there was a distinct tendency for this value to decrease

TABLE 4.—*Effect of the Rachitic Diet and of Antirachitic Measures on the Inorganic Blood Phosphate of Adult Rats*

Rat No.	Age, Months	Diet	Phosphorus	Calcium
5	8	Control	4.22	.....
5	8	Rachitic, 3 days	3.4	.....
5	9	Rachitic, 22 days	1.8	.....
300	9	Rachitic, 1 month	1.8 mg.	10.33 mg.
			Phosphorus × calcium = 18.594	
300	9	Rachitic, 2% cod liver oil, 4 days	3.3 mg.	.....
300	9½	Rachitic, 2% cod liver oil, 15 days	5.2 mg.	.....
12	9	Rachitic, cod liver oil, 20 weeks	4.23	.....
322	9½	Control	4.11	.....
322	10	Rachitic irradation 13 days	3.9	.....
322	10½	Rachitic irradiation 28 days	2.3	.....
301	10	Rachitic nonirradiated cholesterol, 11 days	5.0	.....
301	10½	Rachitic nonirradiated cholestrol, 22 days	4.4	.....
328	10	Control	4.1	.....
328	10½	Rachitic irradiated cholesterol, 11 days	4.5	.....
328	10⅞	Rachitic irradiated cholesterol, 22 days	4.9 mg.	.....
70	10	Rachitic irradiated cholesterol, 20 weeks	5.4	.....

TABLE 5.—*Effect of Irradiation on the Inorganic Blood Phosphate of Young Rats*

Rat No.	Diet	Previous	Age, Weeks	Phosphorus
372	Control	.....	8	6.25
368	Control	.....	8	6.27
365	Rachitic, 10 days	Control	9½	3.75
372, 368	Rachitic, 10 days	Control	9½	3.5
364, 365	Rachitic, 17 days	Control	10½	2.46
368	Rachitic, 17 days	Control	10½	2.3
364	Rachitic, 31 days; irradiation, 14 days	Control	12½	3.0
365	Irradiation, 14 days	Control	12½	2.4
372	Control, 1 week	Rachitic	13½	6.0
365	Control, 1 week	Rachitic	13½	9.0
365	Control, 4½ weeks	Rachitic	17	6.6

gradually (rat 322, table 4). Irradiation of the young, rapidly growing rats, from 8 to 12 weeks old, had no apparent effect on the inorganic blood phosphate (rats 364 and 365, table 5). It remained at the same level after fourteen days irradiation as it had been after seventeen days of rachitic diet without irradiation. However, after this treatment, one week on a control diet raised the blood phosphate of these rats to the high values of 6 and 9 (rats 372 and 365, table 5). Three weeks later, the value for rat 365 was reduced from 9.0 to 6.6 mg., which is about normal for this age.

Added Cod Liver Oil.—The addition of 2 per cent cod liver oil to diet 3143 in contrast to the effect of irradiation of the animal raised the inorganic blood phosphate of both young and old rats. A rat, aged 9 months, after one month on the rachitic diet, had an inorganic blood phosphate of 1.8 mg. (and a calcium concentration of 10.33 mg. with a product of 18.6, as shown in rat 300, table 4). Two per cent of cod liver oil was then added. In four days the phosphate was raised to

TABLE 6.—*Effect of Various Additions to the Rachitic Diet on the Inorganic Blood Phosphorus of Young Rats*

Rat No.	Age, Weeks	Diet	Previous	Rickets	Phosphorus	Calcium
489, 490	8	Control	.....	None	6.25	.....
491	8	1 week rachitic followed by 2 weeks rachitic + 2 per cent cod liver oil	Control	None	4.3	.....
489	11	5 weeks rachitic + 2 per cent cod liver oil	Control	None	5.4	.....
		Rachitic + added substance				
123	8	Nonirradiated palmitic acid, 21 days	Control	Marked	2.74	.....
123, 133	9	Nonirradiated palmitic acid, 28 days	Control	Marked	2.75	.....
127, 131	8	Irradiated palmitic acid, 21 days	Control	Paralyzed	4.68	.....
128	10	Nonirradiated oleic	.....	Paralyzed	2.85	.....
130	9½	Irradiated oleic acid, 31 days	.....	Paralyzed	3.45	.....
136	10	Irradiated oleic	Control	Marked	3.96	.....
136	21	Irradiated oleic	.....	very feeble Paralyzed	4.87	.....
105	8½	Irradiated lecithin, 25 days	Control	Moderate	3.1	.....
153	15	Nonirradiated tyrosine	.....	Marked	2.6	.....
154	15	Nonirradiated tyrosine	.....	Marked	2.44	.....
152	12	Irradiated tyrosine	.....	Moderate	2.49	.....
150	15	Irradiated tyrosine	.....	Marked	3.8	.....
155	15	Irradiated tyrosine	.....	Marked	3.68	.....
156	15	Irradiated tyrosine	.....	Marked	3.54	.....
485	11	2 per cent nonirradiated cholesterol, 21 days	.....	Moderate	3.8	.....
220	13½	Irradiated cholesterol	.....	Absent	2.8	.....
221	13½	Irradiated cholesterol	.....	Absent	3.57	.....
233	15½	Irradiated cholesterol	.....	Absent	3.8	.....
206	19	Irradiated cholesterol	.....	Absent	3.2	10.38
				Calcium × phosphorus = 33.216		
203	19	Liquid ammonia extract of cod liver oil, 0.3 mg. daily	.....	Absent	2.3	10.77
				Calcium × phosphorus = 24.77		
208	19	Liquid ammonia extract irradiated cholesterol; aged sample (inactive)	.....	Marked	2.5	10.36
				Calcium × phosphorus = 25.9		
436	16	Active liquid ammonia extract of irradiated cholesterol, 0.3 mg. daily	.....	Absent	2.3	11.9
				Calcium × phosphorus = 27.37		
422	16	0.15 mg. of above active extract	.....	Very mild	1.7	12.74
				Calcium × phosphorus = 21.65		

3.3 mg., and in fifteen days it was raised to 5.2 mg., which is a slightly higher value than the average for rats that age. That this increase in phosphate with the addition of cod liver oil is not temporary is shown by the fact that another rat, aged 9 months, which had been fed the diet plus cod liver oil for twenty weeks, had a blood phosphate of 4.23 mg. Young rats kept on a rachitic diet three weeks with the addition of cod liver oil for two weeks of that period had a blood phosphate of 4.3 mg. (rat 491, table 6). After five weeks on the rachitic diet plus cod liver oil, the blood phosphate was 5.4 mg. (rat 489). The phosphate value for control rats of the same age was 6.25 mg.

These results agree with those reported by Robison and Soames.[2] Their rats, fed the McCollum diet 3143, had a blood phosphate of from 2.1 to 3.2 mg., which agrees with the figures obtained by us for rats from 8 to 12 weeks old. They believe that this low value for blood phosphate can be ascribed to the low availability of phosphate derived from cereals in this diet, since other groups of their animals developing equally severe rickets on diets in which the phosphate was all supplied in the inorganic form had normal blood phosphate values (from 5.1 to 8.6). They report that the addition of cod liver oil to the McCollum diet 3143 raised the blood phosphate to values of from 4.1 to 5.4 mg. The addition of cod liver oil to the other rachitic diets had no influence on the blood phosphate but did have the usual effect in preventing rickets.

Effect of Irradiated Cholesterol.—In October, 1924, we [9] started a series of experiments to test the antirachitic properties of irradiated and nonirradiated cholesterol, lecithin, oleic and stearic acids and tyrosine. In confirmation of the results reported by Hess and Steenbock, we found that of these substances cholesterol was the only one capable of acquiring antirachitic properties when irradiated with ultra-violet light.

The addition of irradiated cholesterol in amounts of 2.5 mg. daily, which entirely prevented rickets as judged by roentgenograms and histologic preparations, seemed to have little effect in raising the inorganic blood phosphate of young rats. The values obtained were 2.8 to 3.8 mg. as compared with 2 to 2.7 mg., the usual values for young rats on the rachitic diet alone (rats 220, 221, 233 and 206, table 6). Control animals of this age gave values of from 6.25 to 6.7 mg. However, we do not wish to lay undue emphasis on these slightly higher values for rats obtaining irradiated cholesterol, since the values we have obtained for rats on nonirradiated cholesterol are of the same order (rat 485, table 6). In the case of mature rats, on the other hand, cholesterol, either irradiated or nonirradiated, maintained the blood phosphate at the normal level (rats 301 and 328, table 4).

Rats receiving 2 per cent of irradiated oleic and palmitic acids and 0.2 per cent of irradiated tyrosine, all of which developed acute rickets, had, with one or two exceptions, blood phosphate values of more than 3 mg. Rats receiving the same materials when they were nonirradiated gave values always under 3 mg. There was no difference that we could observe in the rats which would indicate a curative effect from irradiated oleic acid, palmitic acid or tyrosine.

One would not wish, on such slight evidence, to draw any conclusions as to the influence of irradiated food on the blood phosphate,

9. Koch, E. M.; Cahan, M. H., and Gustavson, R. G.: J. Biol. Chem. **67**:52, 1926. Koch, E. M., and Cahan, M. H.: Proceedings of the Institute of Medicine of Chicago, April, 1926.

irrespective of its antirachitic properties. We simply wish to note here that the inorganic blood phosphate is influenced by many factors, some of which we do not yet understand. It is not possible now to use the concentration of this constituent in the blood as an infallible criterion for the antirachitic properties of a given diet.

Effect of Diet on the Product of Calcium × Phosphorus.—Emphasis has been placed on the importance of using the product of the phosphorus concentration and the calcium concentration in milligrams per hundred cubic centimeters as an indication of rickets. In a number of instances, when sufficient blood was available, we determined the calcium as well as the phosphate on both rachitic and nonrachitic rats.

We have been able, by means of liquid ammonia, to extract from irradiated cholesterol and from the nonsaponifiable fraction of cod liver

TABLE 7.—*Inorganic Blood Phosphate of Rats Returned to a Control Diet after Developing Rickets*

Rat No.	Age, Weeks	Diet	Previous	Condition When Placed on Control Diet	Phosphorus
351	13	Rachitic, 8 weeks.....	.....	Moderate rickets	3.1
345	13	Rachitic, 8 weeks.....	.....	Moderate rickets	2.44
345, 346	14	Control, 1 day.....	Rachitic	Moderate rickets	4.04
351	14	Control, 1 day.....	Rachitic	Moderate rickets	5.0
352	15	Control, 7 days.....	Rachitic	Marked rickets	9.9
342	15	Control, 7 days.....	Rachitic	Marked rickets	10.0
344	16½	Control, 16 days.....	Rachitic	Marked rickets	10.2
343	16½	Control, 16 days.....	Rachitic	Moderate rickets	7.5
352	16½	Control, 16 days.....	Rachitic	Marked rickets	8.54
344	17	Control, 20 days.....	Rachitic	Marked rickets	8.9
315	17	Control, 20 days.....	Rachitic, irradiated lecithin	No gross rickets	6.0
343	17	Control, 20 days.....	Rachitic	Moderate rickets	7.5
344	19	Control, 34 days.....	Rachitic	Marked rickets	7.3
343	19	Control, 34 days.....	Rachitic	Moderate rickets	6.7
343	20	Control, 41 days.....	Rachitic	Moderate rickets	5.9
343	21	Control, 48 days.....	Rachitic	Moderate	5.7

oil a resinous material, which when fed in amounts of from 0.2 to 0.3 mg. daily, entirely prevented rickets.[9] These rats and those receiving irradiated cholesterol were in especially good condition. Roentgenograms showed no evidence of rickets. Table 6 gives the values for phosphorus, calcium and the product of phosphorus × calcium. Rat 203 received the extract of cod liver oil and rat 436 the extract of irradiated cholesterol. The calcium values for these rats are normal, 10.36 and 11.9, while the values for phosphate are sufficiently low to bring the products of phosphorus × calcium within the rachitic range as given by Howland and Kramer.[10]

Rat 422, which developed mild rachitic symptoms on a daily dose of 0.15 mg. of the liquid ammonia extract of irradiated cholesterol, and rat 208, which received an aged, inactive ammonia extract of irradiated cholesterol and became markedly rachitic, had similar low products.

10. Howland, J., and Kramer, B.: Calcium and Phosphorus in Serum in Relation to Rickets, Am. J. Dis. Child. **22**:105 (Aug.) 1921.

The product of phosphorus × calcium for rat 206, which was receiving irradiated cholesterol, was 33.2, just within the range given by Howland and Kramer for "healing rickets."

This evidence appears to show that while certain antirachitic measures do tend to raise the inorganic blood phosphate of rats fed McCollum diet 3143, it is possible to have animals nonrachitic so far as roentgenograms and histologic examination can show, which have an inorganic blood phosphate and a product of phosphorus × calcium fully as low as the values obtained for rachitic animals.

Control Diet After Rachitic Diet.—When animals which had been on a rachitic diet were returned to a control diet, the blood phosphate of rats from 15 to 17 weeks of age quickly reached the high values of young rats, i. e., from 8 to 10 mg. In two cases, twenty-four hours on a control diet raised the phosphate from the low values of 2.4 mg. and 3.1 mg. to 4 and 5 mg., respectively (rats 345 and 351, table 6). After seven days on the control diet, the phosphate was 10 mg. This increase in phosphate seems to be roughly proportional to the severity of the rachitic condition. There is a period of rapid calcification of the bone in such animals just as there is in young animals. After a period of from two to three weeks the inorganic blood phosphate of these rats decreased until at the end of six weeks it had reached approximately normal values.

SUMMARY

The inorganic blood phosphate of rats, aged 6 weeks, on the control diet was from 8 to 10 mg. This decreased rapidly to 6 or 7 mg., and then gradually to 4 or 5 mg. for the mature rats.

Young rats fed the McCollum diet 3143 had an inorganic blood phosphate of from 2.3 to 3 mg., while the phosphorus values of mature animals on this diet were as low as 1.6 and 1.8 mg.

Irradiation had no effect in raising the phosphate value of the young rats, but did tend to maintain the phosphate value of mature rats on a higher level than that of the nonirradiated animal.

The addition of cod liver oil to this diet raised the phosphate value of young rats to about twice the low values, that is, from 4.3 to 5.4 mg. This was still appreciably lower than the normal values for rats of the same age.

The additions of cod liver oil to the rachitic diet raised the blood phosphate values for mature rats to normal figures.

Growing rats receiving irradiated cholesterol did not develop any signs of rickets. Nevertheless, they had only slightly higher values for phosphate than those receiving the diet alone. Young rats receiving nonirradiated cholesterol had a similar phosphate concentration but developed rickets.

The addition of irradiated and nonirradiated cholesterol to mature rats again tended to keep the phosphate normal.

Other groups to which irradiated oleic and palmitic acids and tyrosine were administered all had blood phosphate values of the same order as those receiving irradiated cholesterol. Nevertheless, these animals all developed acute rickets.

A return to the control diet after the rachitic diet raises the blood phosphate to the high level of young rats from 8 to 10 mg. The phosphorus concentration declines rather quickly, so that at the end of six weeks it is approximately normal.

The results of this study indicate that while cod liver oil raises the blood phosphate to approximately normal, and direct irradiation of the animal and feeding of irradiated cholesterol have some influence in raising blood phosphate, it is still possible to obtain a low phosphate value and a low product of phosphorus $\times$ calcium in an animal which, so far as roentgenograms and histologic examination can demonstrate, shows a perfect calcification of the bones.

PAPILLEDEMA AND THE DIAGNOSIS OF EPIDEMIC ENCEPHALITIS *

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Since the recognition of epidemic encephalitis as a clinical entity, numerous additions have been made to its bizarre symptomatology. Physicians have been led to believe that almost any neurologic syndrome is possible in this disease. As a result, there is a tendency to attribute obscure neurologic pictures to the disease, without the continuous and careful study that such cases require. It may be difficult at the particular moment to criticize the diagnosis. No one, at the time, has anything better to offer. In not a few instances, unless something specific occurs to bring the diagnosis into question, the case goes on record as encephalitis.

How often such errors are committed it is not possible to say. The tendency to let this disease explain complicated symptoms is well known. Some cases have been followed to their denouement only to show other pathologic changes that accounted for the symptoms.

Sakorrafos [1] obtained the complete clinical picture of epidemic encephalitis in a man, aged 57 years, who had diplopia, ptosis, somnolence and occasional fever. The cerebrospinal fluid appeared to confirm the diagnosis. After a month of illness, the patient died and autopsy revealed a sarcoma of the midbrain. Lenoble [2] reported a tumor of the brain in a man, aged 50 years, with symptoms suggesting encephalitis, Morrison [3] observed a case of melanoma of the brain resembling epidemic encephalitis.

The presence of true papilledema in epidemic encephalitis has been reported from several sources. Holden [4] noted one of true choked disk and four showing blurring of the disks in 100 cases of encephalitis. An elevation of 2.5 diopters is reported in one of twenty cases studied at the Neurological Institute. An English report [5] covers 1,250 cases and gives

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1. Sakorrafos: Sarcoma of Mid-Brain, Ann. de méd. **14**:155 (Aug.) 1923.
2. Lenoble, Baumier and Dujardin: Brain Tumor Suggesting Encephalitis, Bull. et mém. Soc. méd. d. hôp. de Paris **44**:1577 (Dec. 17) 1920, abstr. in J. A. M. A. **76**:686 (March 5) 1921.
3. Morrison, A. W.: Case of Melanoma of Brain Resembling Epidemic Encephalitis, Journal Lancet **42**:37 (Jan. 15) 1922.
4. Holden, W. A.: Acute Epidemic Encephalitis, Tr. A. Res. Nerv. & Ment. Dis., 1921.
5. Reports on Public Health and Medical Subjects, no. 11, 1922, p. 84.

5.5 per cent as showing optic neuritis. In only two cases, however, was true choked disk diagnosed. In February, 1919, Smith [6] presented a case of encephalitis showing a papilledema of 5.5 diopters in the right eye and 5 in the left. The onset of the illness occurred three and a half months before presentation at the Philadelphia Neurological Society. The patient complained of a heavy dull feeling in the frontal region, followed by severe headache. Nausea and projectile vomiting were present. The improvement lasted from December, 1918, to Jan. 8, 1919, on which date there was again intense headache, drowsiness, nausea and vomiting. In the light of the cases here reported, it would be interesting to know what the outcome was. Was it really a case of encephalitis?

What is the status of papilledema as a symptom in epidemic encephalitis?

There is a unanimity of opinion as to its rarity in this condition. Bramwell,[7] reporting a group of fifty-seven cases, says: "Changes in the fundi oculi are seldom met with, although in several cases I have seen engorgement of the veins." Barker [8] and his co-workers say that "outspoken choked disk was not present in any of the cases—and judging from the reports, is not met with, although a slight optic neuritis may occur." Tilney and Howe,[9] in their treatise on encephalitis, say: "Lesions of the fundus are usually absent, but there may be a slight degree of papilledema."

Yet the literature contains not a few reports of epidemic encephalitis with choked disk. Some appear to be indisputable cases. In others, a sufficient interval of time has not elapsed to mark them unquestionably as true cases. Heagey,[10] Urbantschitsch,[11] and Sands [12] have reported cases in which swelling of the nerve heads has been a feature. Foster Kennedy [13] has described a series of cases which he calls "acute benign meningo-encephalitis," characterized by "the rushing onset of optic neuritis late in the illness, synchronizing with amelioration of symptoms

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6. Smith, D. E.: Encephalitis Simulating Brain Tumor, Tr. Philadelphia Neurological Society, Arch. Neurol. & Psychiat. **1**:796 (June) 1919.

7. Bramwell, E.: Encephalitis Lethargica, Lancet **1**:1152 (May 29) 1920.

8. Barker, L. F., et al.: On the Epidemic Acute and Subacute Nonsuppurative Inflammation of the Nervous System Prevalent in the U. S. in 1918-1919, Am. J. M. Sc. **159**:340 (March) 1920.

9. Tilney, F., and Howe, H. S.: Epidemic Encephalitis, New York, Paul B. Hoeber, 1920, p. 104.

10. Heagey, F. W.: The Cerebellar Manifestations of Epidemic Encephalitis, New York M. J. & M. Rec. **116**:321, 1922.

11. Urbantschitsch, E.: Intermittent Choked Disk and Abducens Paralysis with Influenza or Lethargic Encephalitis, Wien. klin. Wchnschr. **33**:166 (Feb. 19) 1920.

12. Sands, I. J.: Epidemic Encephalitis Simulating Brain Tumor, M. Rec. **101**:494 (March 25) 1922.

13. Kennedy, Foster: Acute Benign Meningo-Encephalitis with Papilledema, Arch. Neurol. & Psychiat. **7**:53 (Jan.) 1922.

previously acquired." These cases all showed manic symptoms, and the relation of the picture to epidemic encephalitis is not clear-cut. The author himself states: "None of them has the general coloring which we have learned to associate with epidemic encephalitis but the fact that they have come to notice during the period of incidence of the disease, and were not familiar to us before that time, is enough to make one cautious about asserting that the two conditions are entirely unrelated."

Sachs,[14] addressing the American Neurological Association in May, 1922, said: "To make matters still more perplexing, choked disk does not necessarily indicate the presence of a neoplasm; especially in these days of encephalitic lesions, moreover, choked disk does sometimes recede spontaneously and recovery from this condition may ensue without surgical intervention." He then proceeded to give the history of a boy, aged 9, with definite cerebellar symptoms, definite right sixth and slight right seventh weakness, nystagmoid movements, adiadokokinesis of the left side, tendency to fall to the left, and bilateral papilledema of 5 diopters. The boy was in the hospital from Feb. 19, 1922, to March 13, 1922, and after three weeks the right eye showed a swelling of 1 diopter, the left of 2 diopters. Sachs goes on to say that the final diagnosis is still in doubt. And it may well be, as it will be shown that such improvement is possible in the presence of a tumor of the brain. Recession of papilledema may be complete in tumor of the brain.

Spiller[15] has reported two cases of encephalitis with high grade choked disk. His first patient, a boy of 16, showed bilateral papilledema of 7 diopters. Headache, persistent vomiting, diplopia, weakness of the left seventh nerve, drowsiness and fever were present. About three months afterward, the lethargy was less, and the facial paralysis had disappeared. There still remained a choked disk of 4.5 diopters in the left eye and 3.5 diopters in the right. About five months later, the eyegrounds were still not normal, but the ophthalmologist stated that "time should clear them up entirely." Spiller's second patient, aged 11, showed diplopia and lethargy. Dr. de Schweinitz found choked disks of between 5 and 6 diopters on each side with hemorrhages above the right disk. Three months later, each disk was elevated 3 diopters. The reduction was attributed to the use of magnesium sulphate rectally. The temperature was normal most of the time, occasionally rising to 100 or 101. About three and a half months after the onset, the boy became profoundly stuporous and died. Autopsy was not obtained.

Are not both these cases closely paralleled by those reported later in this paper which were not encephalitis?

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14. Sachs, B.: Shall We Decompress for Choked Disk? Arch. Neurol. & Psychiat. **8**:515 (Nov.) 1922.

15. Spiller, W. G.: High Grade Choked Disks in Epidemic Encephalitis, J. A. M. A. **80**:1843 (June 23) 1923.

Has the diagnosis of encephalitis in those cases in which papilledema occurred been confirmed by necropsy?

Heagey,[10] discussing the presence of choked disk in doubtful cases, says: "Vision in three of our cases was badly disturbed and in one the argument for decompression was met only by the experience gained in an analogous case where decompression had been futile. At autopsy, the optic tracts in two cases showed no changes." But the autopsy reports are not given. Particularly in neurologic cases, it may be said that the absence of anatomic proof, despite the accuracy of the clinical observations, is sufficient to relegate any case to the field of the doubtful. Naccarati [16] reports a case of epidemic encephalitis with papilledema simulating tumor of the brain. Thirty-nine days after the onset, there was complete disappearance of a bilateral papilledema of 3 diopters. Yet, as if to suggest that no case is complete without anatomic corroboration, he quotes Lama,[17] who reported a case of tuberculoma of the subthalamic region, which intra vitam had presented a symptomatology similar to epidemic encephalitis.

On the other hand, papilledema has always been recognized as a classic symptom of neoplasm of the brain. Wechsler [18] says: "There is no question, of course, that choked disk is at present the best single sign of brain tumor. It is found in from 65 to 80 per cent of cases and its occurrence in any patient is said to be significant of brain neoplasm in 90 per cent." Such papilledema is often thought of as persistent and progressive. In the vast majority of cases, it does increase and its progressiveness is said to be an index as to the advisability of relief by decompression. But papilledema due to tumor of the brain can retrogress and in some cases can disappear completely. With this, there may also be a partial or even complete regression of symptoms to suggest a cure. In all probability, such regression cannot last a long time. In one of my cases improvement lasted for approximately five months. In the light of this, I urge the important point that comparable cases showing remissions, reported as epidemic encephalitis because of the very retrogression of symptoms, may possibly not have been uncomplicated cases of epidemic encephalitis.

Two cases are presented that are pertinent to this discussion. In both, the diagnosis of encephalitis was made. In both, recovery was looked for in the stage of regression. In both, the presence of a tumor of the brain was found at operation.

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16. Naccarati, S.: Case of Epidemic Encephalitis with Papilledema Simulating Brain Tumor, N. Y. M. J. **116**:326 (Sept. 20) 1922.

17. Lama, A.: Tumore del mesencefalo con sintomatologia simile a quella dell' Encefalite Letargica. Studium **11**:10 (Oct.) 1921.

18. Wechsler, I. S.: Significance of Papilledema in Brain Tumors, New York State J. Med. **22**:354 (Aug.) 1922.

REPORT OF CASES

CASE 1.—*History.*—E. S., a girl, aged 9, was admitted to the hospital Nov. 1, 1925, complaining of headache and vomiting. The condition began two weeks previously, with severe headache and vomiting, when the child appeared drowsy but slept less than before. One week later she developed loss of power in the left arm, but seemed to be regaining its use at the time of admission. No history of double vision could be elicited.

The family and past history were without interest.

On examination, the child appeared drowsy but cried out at times. Questions were answered listlessly. The pupils were equal and reacted to light; the neck was not stiff, and there was an almost complete loss of power in the left upper extremity and to a less extent in the left lower extremity. A left Babinski sign and a left ankle clonus were present. A left facial paresis was present. The tongue deviated to the left. No sensory changes were demonstrable. There was no loss of sphincter control. The palate moved less on the affected side. The lower abdominal reflexes were present, but the upper reflexes were not obtained. The knee reflexes were hyperactive, the left greater than the right. The pulse rate was 64.

On November 2 the spinal fluid was under increased pressure and was slightly hazy. It contained 8 lymphocytes; albumin, +++; globulin, +; sugar, ++. The blood and spinal fluid Wassermann reactions were negative. The quantitative figures were: Sugar, 67 mg. per hundred cubic centimeters, which was 71 per cent of blood sugar; protein, 75 mg., and chlorides, 714 mg. Left oculomotor weakness was present, with the left pupil somewhat irregular. The neck was slightly stiff. A suspicious Kernig sign was present. Some improvement took place in the left lower extremity.

On November 3 the eyegrounds showed papilledema of 3 diopters in the right eye, with flame-shaped hemorrhages around the periphery of the nasal side of the disk. Swelling of the left nerve head was less marked than the right. The spinal fluid was under increased pressure and was definitely xanthochromic. About 26 cc. was removed. It showed 26 cells, 50 per cent of which were lymphocytes; albumin, ++++; globulin, ++++, and sugar, ++. The fluid almost boiled solid on heating. The quantitative figures were: sugar, 83 mg. per hundred cubic centimeters, which was 66 per cent of blood sugar; protein, 615 mg., and chlorides, 714 mg.

In view of the xanthochromic spinal fluid, the papilledema, the slow pulse and the persistent headache and vomiting, the diagnosis of tumor of the brain appears justified.

On November 4 ptosis of the right eye was present, with papilledema of 3 diopters in both eyes. There was paralysis of the right lateral rectus.

On November 5 the right sixth nerve was completely paralyzed. The papilledema was unchanged. Neither nystagmus nor corneal hyperesthesia was present. There was no evidence of hemianopia. The attending neurologist thought that there was a right sided midbrain lesion, probably a neoplasm. Ventricular puncture was advised.

On November 6 the child was definitely improved; the headaches were less severe. The neck was somewhat stiff. A bilateral Kernig sign was present. One ounce of magnesium sulphate was given per rectum and by mouth.

Roentgen-Ray Report.—Increased convolutional impressions were present throughout, suggesting increased intracranial pressure. There was diastasis of the coronal sutures. The middle fossa was slightly depressed, and the posterior clinoid was slightly atrophied. An indefinitely circumscribed area was present in the midbrain, with small calcific areas at a point 1½ inches (3.7 cm.) above the midfossa, suggesting the presence of a tumor of the brain.

On November 8 the paralysis of the left side was almost entirely gone. Paralysis of the right lateral rectus was still present. Ptosis persisted on the right side.

On November 11 the condition was little changed, though clinically the child was greatly improved.

On November 12 Barany caloric tests showed normal function in both labyrinths. Hemorrhages in the retinas showed signs of absorption; the disks appeared less elevated.

On November 13, the child's constant clinical improvement was sufficient to deter any operative procedure.

On November 14 Dr. Foster Kennedy noted:

"Findings are compatible with glioma in the region of the right pons into which hemorrhage has occurred, but hemorrhage is extremely unlikely in a child. Impression: Brain tumor, tuberculoma?—not necessarily in the right pons but further forward (midbrain) or right cerebral hemisphere. Do not recommend action at present." Another attending neurologist thought that the condition was a lesion of the pons on the right side, but, in view of the relatively sudden onset with prompt amelioration, considered the process an infection; however, he did not feel that tumor could be ruled out.

On November 23 the child continued to improve subjectively and objectively. The papilledema was less marked, down to 1 diopter in both eyes. The paralysis of the right sixth nerve remained unchanged.

On November 30 the child seemed well and happy. The neurologic examination showed the condition to be little changed. The right sixth and left seventh nerves showed weakness. A Babinski sign was present on the left.

On December 7 the child was up and about, playing around as if perfectly well. She made no complaints. The fundi showed improvement. The right disk was almost normal.

On December 11 both fundi were entirely clear. No internal strabismus was present.

On December 14, the child complained on occasion of temporary attacks of diplopia, but otherwise was normal.

On December 29, the fields were normal. In the right eye, the blind spot was normal. No scotoma was present. Central color vision for red, green and blue was normal. The left eye showed good central color vision. There was concentric contraction of the form fields. No muscular paralysis was present. The arteries were normal. No hemorrhages could be seen.

On December 29 an attending neurologist diagnosed the condition as encephalitis. A tuberculoma with acute inflammation around it would not clear up so completely or so quickly.

On December 30 the patient was discharged, apparently cured.

Treatment.—The only therapy used was for the relief of the headaches. Magnesium sulphate, 1 ounce, was given from November 4 to November 13. The spinal taps have already been noted.

Subsequent Course.—The child was readmitted, April 15, 1926, with the complaint of unbearable headache and vomiting. After discharge at the end of December, 1925, she had felt perfectly well until three weeks before the second admission, except for occasional headaches, which had not been troublesome. Since that time, the headaches had become almost unbearable; she had vomited almost every day for the past three weeks; the vomiting had never been projectile. For the last week the left arm had been growing weak. No fever, convulsions or twitchings had been present. There was no history of uncinate fits.

The child looked ill and was somewhat drowsy. The pupils were equal and reacted to light. The neck was slightly stiff. A left facial paralysis was present, as well as a flaccid, almost complete, paralysis of the left arm. The left sixth nerve was paralyzed. There was no weakness of the left leg. Both knee reflexes were hyperactive, the left greater than the right. A left Babinski sign and a left ankle clonus were present. The abdominal reflexes were present, the right greater than the left. No sensory disturbances were noticed. A bilateral papilledema of from 4.5 to 5 diopters was present. No speech defect or astereognosis was found.

On April 26, a lumbar puncture gave 15 cc. of clear yellowish fluid with a pressure of 29 cms. The fluid showed: cells, 14; globulin, ++; albumin, ++. The quantitative figures were: sugar, 65 mg. per hundred cubic centimeters, which was 60 per cent of blood sugar; protein, 75 mg.; chlorides, 737 mg. Twenty-four hours after the tap, the child developed nystagmus, with rapid component to the right. The pulse was irregular (108). The systolic blood pressure was 100; diastolic, 62. The white blood cells numbered 14,000; polymorphonuclears, 78 per cent; lymphocytes, 22 per cent. Tuberculin, 1/20 mg. given intradermally, gave a positive reaction.

Dr. Foster Kennedy and Dr. E. D. Friedman diagnosed independently: A frontal neoplasm, either frontal or temporofrontal in location.

On April 30 the lumbar puncture was repeated. Twenty cubic centimeters of clear, yellow fluid was withdrawn at the rate of 15 drops a minute. The pressure was not tested. The fluid showed: 8 cells, lymphocytes; globulin, ++; albumin, ++. The quantitative figures were: sugar, 60 mg. per hundred cubic centimeters, which was 30 per cent of blood sugar; protein, 268 mg.; chlorides, 714 mg. The pulse was 48 per minute before the tap, rising to 82 a half hour after.

On May 1 Dr. Joseph E. King operated for tumor of the brain and found a neoplasm with hemorrhagic and cystic degeneration covering the right frontoparietotemporal regions. When the usual osteoplastic flap on the right side was turned up, there was marked erosion of the inner table resulting in the formation of ridges and grooves or sulci. The dura was thickened and tense; it did not pulsate and bled profusely from small vessels over the surface. On exploration with a cannula, a cystic cavity was entered and about 4 cc. of clear yellow fluid withdrawn. When the cannula was inserted deeper, 25 cc. of a thick grumous, brownish-red fluid was obtained. This decreased the tension and after the dura was opened there was no surface marking indicating a tumor except the marked depression in the right temporofrontoparietal region, directly over the site of the aspirated cyst. No attempt was made to explore the cavity, but the procedure was left as a decompression. It was noted that the condition of the patient on leaving the table was good. Despite this, she grew steadily worse in the few hours after the operation, and died eight hours later.

CASE 2.—A. G., a boy, aged 3, was admitted to the hospital, Dec. 8, 1925, with the complaint of loss of function in the right hand, loss of expression in the right side of the face, excessive sleeping, from eighteen to twenty hours daily, left sided headache, general weakness and loss of appetite. The child had fallen shortly before the onset of the present complaint, about two months previously. He did not vomit after the fall. There were no convulsions or other untoward symptoms.

The family and past history were of little interest. There had been a purulent discharge from the right ear four months previously. On examination, the child did not look constitutionally ill. The pupils reacted to light, with hippus on the right. A right facial paralysis, weakness in the right hand and slight weakness of the right arm and right leg were present. No sensory disturbance was noted. A right Babinski sign was present. The knee reflexes were hyperactive. The eyegrounds were normal. Diphtheria antitoxin was given because of a suspicious throat. The temperature was 103 F.

On December 9 lumbar puncture revealed fluid that was clear, under slightly increased pressure and contained 21 cells. No albumin was present, and there was a trace of globulin. The colloidal gold test was 0000000000. The Wassermann reaction was negative. The quantitative figures were: sugar, 46 mg. per hundred cubic centimeters, which was 69 per cent of blood sugar; protein 44 mg.; chlorides, 714 mg.

On December 12 the spinal fluid was clear and under normal pressure; it showed 6 cells; globulin, +; albumin, ++; sugar, ++. The quantitative figures were: sugar, 73 mg. per hundred cubic centimeters, which was 86 per cent of blood sugar; protein, 50 mg.; chlorides, 714 mg.

On December 14 the condition was unchanged. The temperature occasionally rose to 101. The pulse was rapid and regular (110).

On December 22 the spinal fluid again showed little change. A Board of Health consultant thought that encephalitis was the most probable diagnosis. An attending ophthalmologist noted slight swelling of both nerve heads.

On December 13 the roentgen ray showed a small area of calcification in the anterior fossa, at a point 1 inch (2.54 cm.) above the sphenoid bone. The sella turcica was of normal size. The clinoids were well formed. No increased intracranial pressure could be seen.

On December 29 the eye consultant noted that the fundi were normal. In all respects the spinal fluid was like that obtained on December 22.

On January 5 the weakness of the left sixth and right seventh nerves was more pronounced. The eyegrounds showed swelling of both disks, which was more marked on the right than on the left. There was marked engorgement of the veins.

On January 7, after double vision had been complained of the previous day, the right pupil was larger than the left and reacted more sluggishly to light.

On January 13 the spinal fluid was essentially the same as before.

On January 14 the condition was little changed, though the child appeared brighter.

On January 19 one of the attending neurologists confirmed the diagnosis of encephalitis.

On January 21 the spinal fluid showed little change. The child showed a tendency to fall to the right, but was otherwise greatly improved. He was discharged to the outpatient department but failed to report as directed.

He was readmitted to the hospital, June 22, 1926, complaining of headache. In the interval since discharge from the hospital, he had never completely recovered from the initial symptoms. He never played with other children as he had done previously. For the last two weeks or more he had been growing drowsy. He was "still weak on the right side of his body."

On examination, the child appeared lethargic and drowsy. A right facial paralysis and weakness of the right arm and leg were present. The Babinski sign was questionable on the right. The right knee reflex was more active than the left. The left abdominal reflex was present; the right was not obtained. The tongue protruded in the midline. No sensory disturbance was present. Both pupils were equal and reacted to light. A bilateral choked disk of 1 diopter was present.

On June 26 Dr. E. D. Friedman diagnosed an expanding lesion of the left hemisphere, which, most likely, was temporal and deep. The child showed right homonymous hemianopsia. Exploration was advised. Spinal fluid was obtained under greatly increased pressure. The fluid showed: albumin, +, globulin, +; sugar, normal (+); 2 cells. The quantitative figures were: sugar, 67 mg. per hundred cubic centimeters, which was 54 per cent of blood sugar; protein, 75 mg.; chlorides, 772 mg.

On June 28, the spinal tap was repeated, under a pressure of 44 cm. The fluid showed 8 cells; globulin, +; albumin, ++; sugar, +. The temperature was normal, on one occasion slightly above 100.

On June 30, Dr. Alfred S. Taylor operated and found a deep seated tumor, a gliomatous cyst, on the left side, which involved the frontoparietotemporo-occipital area. The cranial vault was suggestive of the prolonged convolutional atrophy type, and the vascular channels were almost absent. A cannula was passed into the lower posterior angle of the wound, through the second temporosphenoidal convolution toward the ventricle. When the cannula had entered about 4.5 cm., fluid was obtained which had a curious greenish-yellow appearance, just like a degenerated glioma. There were also flocculi of solid material in the fluid. About 80 cc. was removed through this opening. The descending horn and the body of the lateral ventricle apparently had been compressed by a large cyst, so the ventricle itself was not entered. After the removal

of this fluid, the left hemisphere collapsed. On palpation, there was still a soft area in the posterior part of the upper left frontal convolution. This was punctured, and exactly the same fluid was encountered as before, about 20 cc. being removed. Under the circumstances it was not possible to see or to feel any solid glioma. Two hours were required for the operation, and it was noted that the child was in surprisingly good condition at the close. Despite this, the child proceeded to go downhill soon after reaching the ward. The temperature rose to 105.8 F., and all stimulation failing, he died at 4:30 a. m., twelve hours after the operation.

COMMENT

It is of more than usual interest to note in both these cases the presence of a tumor of the cystic degeneration type. The regression of symptoms strongly suggests a change in the volume of the cyst. How this is produced is problematic. However, at least in case 1, the explanation suggests itself that the presence of marked xanthochromia in the spinal fluid obtained at the second puncture after a clear fluid at the initial puncture is in all probability the result of a spilling over of some of the contents of the cyst into the cerebrospinal fluid. It will be remembered that at operation it was found that the mass had undergone hemorrhagic cystic degeneration.

How much absorption may occur in the cystic type of tumors one is not prepared to say. There does appear to be an adequate explanation for the regression of symptoms in the change, no matter how produced, in the volume of the cystic mass. With the filling up comes an exacerbation of the signs and symptoms previously noted.

CONCLUSIONS

1. In cases showing symptoms of involvement of the central nervous system, plus papilledema, the burden of proof is on the clinician making the diagnosis of encephalitis.

2. Two cases are reported which presented all the features of epidemic encephalitis, plus papilledema, and which were diagnosed as such. They proved on operation, however, to be neoplasms of the brain.

3. There may be partial and even complete recession of papilledema in tumor of the brain.

4. Partial, and even almost complete, remission of symptoms may occur in tumor of the brain.

HICCUPS AMONG INFANTS*

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It has been demonstrated experimentally that irritation of the human esophagus will cause hiccups.[1] It was later observed that infants may start to hiccup shortly (within about ten minutes) after regurgitation following nursing. It seemed probable that the irritation from gastric fluids lying in a sensitive esophagus might cause the hiccups. Possibly this irritation would be increased by curdled particles of milk. It is true that hiccups occurring after nursing were not always preceded by visible regurgitation. Regurgitation was noted in eighteen out of fifty-one attacks of hiccups studied. However, fluids might easily pass up the esophagus without actually leaving the mouth, and so escape notice. On the other hand, hiccups did not always follow definite vomiting. It is thought that, as a rule, in such cases the gastric contents did not especially irritate the esophagus. It seemed reasonable that an attack of hiccups might be stopped, momentarily at least, by washing any material in the esophagus back into the stomach. This was tried, the work being done in the Presbyterian Hospital of Chicago. Of course, water has been included in the past among the numerous measures listed for controlling hiccups, being included apparently on an empiric basis. I find that many physicians think there is little of practical value to be done for an attack of hiccups occurring after nursing. The rationale and the real value in using water are not generally recognized.

TREATMENT

A relatively normal group of infants was used. The ages ranged from birth to about 15 days. Approximately two thirds of the infants in this group were subject to at least occasional hiccups. While many attacks were short, still an ordinary one might last from five to fifteen minutes, the hiccups occurring about eighteen times a minute. No way was found of foretelling the probable time at which an attack would stop, although many observations were made with this point in mind. There was no discrimination in the type of attacks handled, the cases being taken as they occurred (opportunity permitting).

Warm water was given by bottle to stop the hiccups. Nipples with large holes proved most satisfactory, as they allowed a better flow of water.

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* From the Hull Physiological Laboratories, the University of Chicago, and Rush Medical College, Chicago.

1. Pendleton, W. R.: Hiccups of Esophageal Origin, to be published.

Supplementary feeding mixtures were used in place of water in several instances and promptly stopped the attack each time. After the progress of a considerable number of untreated attacks was observed, fluids were used in fifty-one cases. The first eleven cases are not considered here because they were handled by a variety of methods in an effort to determine the best technic, and because insufficient data were kept. The results were similar to those in the following forty cases. Twenty-three (57.5 per cent) infants stopped hiccuping with the first swallow—this fact that more than half stopped hiccuping immediately should not be overlooked—three (7.5 per cent) hiccuped one or two times after drinking was started; three (7.5 per cent) stopped after from six to ten hiccups, and eleven (27.5 per cent) were stopped with difficulty or failed to stop during treatment. In none of the twenty-nine cases in which treatment was successful was the attack resumed. In two of the eleven refractory cases, the attack started again. The proportion of success and failure was roughly about the same in the various parts of this work. Even when the attacks were not stopped, the severity of the hiccups was generally decreased during the administration of fluid.

From 1 to 15 cc. of fluid was used in the twenty-nine cases in which hiccups stopped while being treated. The average was 6.7 cc. In certain of the eleven refractory cases, a larger amount of fluid was used in an ineffectual effort to stop the attacks.

In the twenty-nine cases in which treatment was successful, infants drank water or supplementary feeding mixture for a period of from seven to one hundred and fifty seconds. The average was thirty seconds. If an attack of hiccups was stopped for fifteen seconds, the chances proved to be slight that it would be resumed later.

In thirteen out of the total of forty cases described, water was administered within from one to two minutes after the onset of hiccups. Of this group, 46 per cent proved refractory. In twenty-seven cases in which fluid was given from three to eight minutes after the onset, only 18 per cent proved refractory. Thus, hiccups seem to become more subject to treatment as an attack progresses. The average duration, prior to treatment, of the entire forty cases presented (27.5 per cent refractory) was three and one-half minutes.

I should list as the principal causes for failure when hiccups proved refractory as, first, an occasional disinclination and again an almost complete refusal of the infants to take fluids. This was at times an important factor, although fortunately most infants took water promptly and many greedily, even though they were hiccuping. A second cause for failure was an ineffectual cleaning of the esophagus with water, and a third cause was repeated regurgitation.

Any tendency to repeated regurgitation was probably decreased by the fact that: 1. Any great tension in the stomach might readily be

relieved by the initial regurgitation. The amount of water taken to stop hiccups was seemingly too small to cause further vomiting. 2. The time between regurgitation and the onset of hiccups and later the administration of fluids would allow for some of the gastric contents to enter the intestine. 3. Hiccups themselves might, by jarring the stomach, hasten the passage of its contents into the intestine and thus partially empty the stomach.

Infants were next permitted to suck nipples on empty bottles for sixty seconds (thirty seconds in one instance) if the hiccups did not stop sooner. If chance is the controlling factor, or if the effort of sucking alone stops hiccups, or if the infant is able to form enough saliva to clean the esophagus unaided, then the attacks should have stopped as readily when these methods were tried as when water was used in the bottles. This was not true. Of the nine infants on whom this was tried, only two (22 per cent) stopped hiccuping. They stopped immediately. The ages were 6 and 9 days, respectively. Possibly sufficient saliva was swallowed to clear the esophagus. The older of the two infants showed some drooling, although the child was still young. The group of infants tested by this method is not larger because when nipples were used without water the attacks became worse, rather than better, in all except the two cases mentioned. This is in marked contrast to the results by the first method (the use of fluids). Possibly any air swallowed would further distend the stomach and cause more of the gastric contents to enter the esophagus than would be the case with an infant that was left alone. A similar situation would probably arise from infants nursing on poorly filled breasts.

Hiccups may occasionally occur between feeding periods if an infant is given all the water it wants. Such an attack was noted. The infant vomited curdling milk from the previous nursing (about one and one-half hours before the water was given) together with some of the water recently taken, and hiccups started in a few minutes. It is thought that the esophagus would be irritated by the gastric contents in a somewhat similar manner, varying, however, in degree, whether the regurgitation was initiated by distention of the stomach with milk, water or air or whether it was the effect of a momentarily spastic stomach or of a poorly functioning valve in the stomach.

SUMMARY

1. This work seems to confirm the hypothesis on which it was undertaken—that certain types of hiccups may be stopped by removing the source of esophageal irritation. The irritant in hiccups occurring after nursing was taken to be partially regurgigated gastric contents lying in the esophagus. The treatment was the administration of fluids rapidly by mouth and in such an amount as would clear the esophagus.

2. When an average of 6.7 cc. of water or complementary feeding mixture was used and an average of thirty seconds taken for consumption of the same, 57.5 per cent of forty infants stopped hiccuping immediately, and 15 per cent stopped fairly readily. In none of the infants who had responded satisfactorily to treatment was the attack resumed.

3. In general, there seemed to be little probability that an attack of hiccups which occurred after nursing had been stopped for fifteen seconds should recur.

4. Nine infants sucking nipples on empty bottles showed poor therapeutic results—the hiccups stopping under treatment in only 22 per cent and being made worse generally when the attacks were not stopped. Thus, the use of fluids seems essential for satisfactory results.

STUDIES IN PUBESCENT GROWTH

WITH SPECIAL REFERENCE TO PERIODIC GAIN *

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During the last six years the opportunity has been afforded us to study the growth of a selected group of boys between the ages of 10 and 18 years who were in attendance at the St. Louis Country Day School. This includes the years of the second period of accelerated growth of the life cycle or the period of pubescence and early adolescence. The records of the six years have been studied from two standpoints: (1) The curve of periodic growth and (2) growth standards.

As many environmental factors influence growth, it is necessary to speak of the material. The average annual enrolment at the school has been around 225. The age of the lowest or entering class averages 10 years, and nearly all the boys remain until entering college. The pupils are in attendance from 9 until 5 daily for five days a week and leave home one hour earlier and return home about 6 p. m. The school has compulsory athletics under supervision for every boy and serves a hot meal in the middle of the day. The academic standards are high, as it is strictly a college preparatory school, and the average intelligence quotient for the school is around 118. The pupils come from well to do homes in which they have had the advantage of the best hygienic surroundings and medical supervision since early infancy. All are native born and are of native born parentage for several generations, as a rule. Every boy receives a physical examination at the beginning of the school year. In contrast to the usual percentages, the boys recorded as having "poor" nutrition average about 3 per cent; dental caries, 1 per cent; uncorrected visual defects, 3 per cent, etc. From the standpoint of health, physical fitness, early medical attention, hygienic surroundings, diet, etc., the group is ideal for studies of growth. In compiling the statistics, the records of all boys who have had serious illness or injury have been eliminated. For the record of a boy to be used, it was necessary for him to be in attendance and under observation for a minimum period of two years.

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PERIOD GROWTH

AVERAGE ANNUAL GAIN

The first analysis of the records was made from the point of view of periodic growth. The records of 704 boys were used in studying the annual increment in height and weight, and the records of 534 in studying seasonal periodic gains.

The average annual growth in height and gain in weight are shown in table 1.

It is interesting to compare these averages with the Baldwin-Wood tables. In the Baldwin-Wood tables, different figures are given for the annual average gain according to a classification into "Short," "Medium,"

TABLE 1.—*Average Annual Gain in Weight and Growth in Height at Yearly Age Levels*

Year	Number of Boys	Increase in Weight, Pounds	Growth in Height, Inches
10 to 11	78	8.4	2.0
11 to 12	84	8.9	2.1
12 to 13	106	10.45	2.45
13 to 14	120	12.5	2.7
14 to 15	108	13.7	2.85
15 to 16	114	12.1	2.0
16 to 17	63	7.9	1.3
17 to 18	31	7.0	0.75

TABLE 2.—*Average Annual Growth in Inches by Years for the "Medium" and "Tall" Body Type in the Baldwin-Wood Tables and in Our Material*

	Year								
	10	11	12	13	14	15	16	17	Total
Baldwin-Wood medium	2	2	2	3	2	2	1	1	15
Baldwin-Wood tall	2	2	3	3	3	2	0	1	16
St. Louis Country Day School	2	2.1	2.5	2.7	2.8	2	1.3	0.7	16

and "Tall" body types. A graph constructed from these three sets of figures shows that our curve corresponds most closely to the curve of the Baldwin-Wood figures for the medium type averages. However, our group does not show as high a peak in any one year as Baldwin and Wood found for each of their types. Thus, in their table, the "Short" type makes an average gain of 14 pounds (6.4 Kg.) in the fifteenth year, the "Medium" type makes an average gain of 15 pounds (6.8 Kg.) in the fourteenth year, and the "Short," 16 pounds (7.3 Kg.) in the thirteenth year, while our maximum is 13.7 pounds (6.2 Kg.) in the fourteenth year. Despite this difference, we find that the total average gain for the eight years is 81 pounds (36.7 Kg.) in our group, as contrasted with 71 (32.2 Kg.) for the "Short"; 71 for the "Medium," and 73 (33.1 Kg.) for the "Tall" in the Baldwin-Wood tables. Thus,

the average total gain is from 8 to 10 pounds (3.6 to 4.5 Kg.) greater in our group, or from 10 to 14 per cent.

While it is probably true that our type of material has a tendency to the "Tall" body type, we find that the annual growth in height in inches corresponds closely to the results of the Baldwin-Wood studies. This is shown graphically in table 2.

Thus the increased gain in weight in our group during these years has no relation to a height factor. The growth as measured by the increment in weight is not only greater as a whole, but is also much more uniformly distributed throughout this cycle of pubescent and early adolescent growth.

SEASONAL PERIODIC GROWTH

Little information is available in regard to seasonal or periodic growth as contrasted with growth standards or yearly gains. As the first weighings of the school year are made the last week in September

TABLE 3.—*Average Gain in Weight (Pounds) by Periods at Year Levels*

Year	Number of Boys	Period 1	Period 2	Period 3
10 to 11	64	2.6	2.4	3.0
11 to 12	54	3.0	2.75	3.2
12 to 13	80	3.5	3.0	3.5
13 to 14	97	4.3	4.0	4.6
14 to 15	69	5.4	5.1	3.1
15 to 16	96	5.6	4.7	2.0
16 to 17	50	5.2	2.8	0.34
17 to 18	24	4.6	2.0	0.66

and the last weighings the last of May, it was found impossible to group the year into the usual four periods of three months each. Hence the year was divided into three periods of four months each. Period 1 includes October, November, December and January; period 2, February, March, April and May, and period 3 the four remaining months, corresponding as a whole to the summer vacation, during which monthly weighings are impractical for purposes of study, as weights during this time are taken on many different scales. As growth in height is in fractions of inches as a rule, the heights were discarded for periodic study, and the curves of seasonal growth were constructed from the body weight figures. All records of underweight and overweight boys were thrown out, as were the records of boys who had been sick or injured. The weighings were all made in the nude.

It will be noted in table 3 that from the tenth through the thirteenth year the gain in weight is distributed fairly uniformly throughout the year. It is slightly lower during period 2, the spring months, than for the other periods. At 14 years, however, a decided change takes place, which becomes marked in the 16 to 18 year level. This is the falling off of the gain in weight during period 3, the summer vacation

months. In the last two years (17 and 18), the table shows further that not only is the average gain in summer less than a pound, but also that the gain in period 1 is twice that of period 2.

MAXIMUM GAIN

A further study was made to determine the period of the year in which the maximum gain was made by each boy. The results are shown in table 4.

This table shows, first of all, that only a small percentage (5.5) show a uniform gain throughout the year. For the greater number, the

TABLE 4.—*The Number of Boys Making Maximum Gain at Each Period by Age Levels*

Year	Period 1	Period 2	Period 3	Uniform
10 to 11	19	16	23	6
11 to 12	16	16	19	4
12 to 13	36	18	24	2
13 to 14	25	30	36	6
14 to 15	27	21	15	6
15 to 16	45	35	12	3
16 to 17	31	10	6	3
17 to 18	12	9	3	0
	211	155	138	30
	40%	29%	25.5%	5.5%

TABLE 5.—*Number of Boys Losing Weight by Seasonal Periods at Age Levels*

Year	Period 1	Period 2	Period 3	Annual
10 to 11	6	5	4	3
11 to 12	3	3	3	2
12 to 13	5	4	9	0
13 to 14	2	4	10	0
14 to 15	2	2	18	1
15 to 16	3	7	27	5
16 to 17	3	6	21	7
17 to 18	3	2	8	6
	27	33	100	24
	5%	6.1%	18%	4.6%

period of greatest gain is in the fall (period 1). If, however, the entire group is divided into two periods, 10 to 14 years and 14 to 18 years, it is found that in the younger group the largest number make their maximum gain in the summer months (period 3). There is not much difference, however, between period 1 with ninety-six maximum gains and period 3 with 102. As a whole, the difference in the lower age groups cannot be said to show much in favor of any one group. The striking difference occurs in favor of period 1 in the 14 to 18 year group.

DISTRIBUTION OF LOSSES IN WEIGHT

In order to complete the study of seasonal periodic growth, the distribution of losses in weight by periods was tabulated and is shown in table 5.

Only 5 per cent showed a loss in period 1 and 6 per cent in period 2. In period 3, however, 100 boys, or 18 per cent, showed a loss. This is largely the result of the losses of weight in the older boys during the summer vacation. If this group alone is calculated, it is found that of the 239 boys in the 14 to 18 year old group, 74, or approximately 33 per cent, lost weight during the summer vacation. For the group as a whole, 4.6 per cent showed a loss for an entire year. This again is almost entirely (eighteen out of twenty-four) in the three highest age levels.

VARIATIONS

Figures regarding the average gain give little information as to the actual gain made by an individual boy. It cannot be said that the average periodic or annual gain is the gain that should be made for a specific individual. Thus, when one studies the amount of variation from the average figures, marked deviations, as shown in table 6, are found.

TABLE 6.—*Range of Gain in Height and Weight**

Year	Number of Boys	Average Gain, Inches	Range of Gain, Inches	Average Gain, Pounds	Range of Gain, Pounds	Per Cent Gaining Over Average
10 to 11	78	2	1½ to 3	8.1	1 to 16 (1) 18 (1)	45
11 to 12	84	2.1	1 to 4	8.9	1 to 20 (1)	37
12 to 13	106	2.45	1 to 4	10.45	3 (3) to 20+ (6)	47
13 to 14	120	2.7	1½ to 5	12.5	3 (3) to 28 (2)	46
14 to 15	108	2.85	1 to 4	13.7	6 (1) to 20+ (17)	56
15 to 16	114	2	¾ to 4	12.1	2 to 20+ (14)	44
16 to 17	63	1.3	0 (7) to 3¾ (3)	7.9	1 to 19	44
17 to 18	31	0.75	0 (7) to 2 (1)	7	0 to 19 (1)	50

* Figures in parenthesis represent the number of boys.

The table shows without further comment the wide deviation from average figures that one encounters. In going over the records, one is struck by the way that a gain considerably more than the average in any one year is either preceded or followed by a year in which the gain is considerably below the average.

GROWTH STANDARDS

The subject of growth standards has been so extensively discussed in recent years that a recapitulation is unnecessary. It is recognized that the only comparison of value is one in which the material under discussion is compared with a table constructed from a like or similar type of material. For several years we have compared the weight-for-height of our material with the Baldwin-Wood and the "Ideal" tables of Gray.[1] The figures for the tables of Gray are based on measurements of boys in private schools in the East and have corresponded more closely to

1. Gray, H., and Jacomb, W. J.: Size and Weight in One Hundred and Thirty-Six Boarding School Boys, Am. J. Dis. Child. **22**:259 (Sept.) 1921.

the actual figures of our material. As no tables for boys in private schools in the Middle West are available, we have constructed our own table, using the measurements of 830 boys in the weight-for-height table and 641 measurements in the weight-for-chest circumference table. The measurements of all overnourished and undernourished boys were excluded.

The deviations of weight of normal healthy boys of a given height from an average figure are marked, and depend largely on the question of body type. A short, stocky boy weighs more and should weigh more than a thin slender boy of the same height, and yet both may be in an

TABLE 7.—*Average Weight (Nude) in Pounds for Height in Inches*

Height	Weight	Height	Weight	Height	Weight	Height	Weight
51	55	56½	77	62	99	67½	127
51½	57	57	79	62½	101	68	129
52	59	57½	81	63	103	68½	132
52½	61	58	83	63½	105	69	135
53	63	58½	85	64	107	69½	138
53½	65	59	87	64½	109	70	141
54	67	59½	89	65	112	70½	144
54½	69	60	91	65½	115	71	147
55	71	60½	93	66	118	71½	150
55½	73	61	95	66½	121	72	153
56	75	61½	97	67	124	72½	156

TABLE 8.—*Average Weight (Nude) in Pounds for Chest Circumference*

Inches	Weight	Inches	Weight	Inches	Weight	Inches	Weight
24	58	27½	86	30½	110	33½	134
24½	62	28	90	31	114	34	138
25	66	28½	94	31½	118	34½	142
25½	70	29	98	32	122	35	146
26	74	29½	102	32½	126	35½	150
26½	78	30	106	33	130	36	154
27	82						

excellent condition of nutrition. In order to obtain a closer theoretical figure of what the individual boy should weigh, we use in practice the average of the weight for height and weight for chest circumference figures. Thus, of two boys with a height of 62½ inches (153.6 cm.), if a weight-for-height table alone is used, both should be figured at 100 pounds (45.4 Kg.). One boy is slender with a chest circumference of 27¾ inches (69 cm.), corresponding to an average weight of 88 pounds (39.9 Kg.). The second boy is stocky with a chest circumference of 29¾ inches (75 cm.), corresponding to 104 pounds (47.2 Kg.). The "standard" weight figure for the first boy is 96 pounds (43.5 Kg.) and for the second, 102 pounds (46.3 Kg.). In practice, this combined figure is much closer to the actual weight of the boy under examination than a weight-for-height figure alone.

Since these figures were obtained, a new table has been published by Gray and Fraley,[2] based on 1,016 boys in private schools in the East. Our figures for the Middle West (weight-for-height) correspond closely to these figures, as will be noted in the comparison given in table 9.

TABLE 9.—*Comparison of Eastern and Middle Western Figures*

Height, Inches	Weight (Gray and Fraley)	Weight (St. Louis Country Day School)
52.0	60.8	59
57.0	....	79
57.1	77.8	..
61.0	94.8	95
65.0	116.6	112
70.5	144.5	144
72.0	151.7	153

SUMMARY

Studies of growth in a group of Middle Western boys in private schools between the ages of 10 and 18 years showed:

1. The average annual growth in weight and height corresponds closely to the figures of previous studies.

2. In the group between 10 and 14 years, the gain is fairly evenly distributed throughout the year. From 14 to 18 years, the gain is chiefly in the period of October to January, inclusive. Little gain takes place in the latter group during the summer vacation months.

3. The period of maximum gain occurred in the fall months for 40 per cent and in 25 per cent in the summer months (chiefly in boys under 14), and in only 5.5 per cent was the gain fairly uniform throughout the year.

4. Only 5 per cent lost weight in the fall months, as contrasted with 18 per cent in the summer months.

5. Growth standards were established for the group and tables of weight-for-height and weight-for-chest circumference constructed.

2. Gray, H., and Fraley, F.: Growth Standards, Am. J. Dis. Child. **32**:554 (Oct.) 1926.

METABOLISM OF SALTS IN NEPHRITIS

III. CHLORIDES AND SODIUM *

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PLAN OF INVESTIGATION

In those cases in which it was possible to study the complete salt metabolism, a plan similar to that outlined in a previous paper [1] was followed. This, in brief, consisted of the careful determination of all sodium and chloride ingested and excreted during a three or four day period, following a preliminary period of three days on the same diet. Blood was withdrawn in the middle of the metabolism period. Complete balance experiments were not always possible, and in many such cases the daily excretion of chlorides and the effect of added sodium chloride on its excretion were studied. Such patients were always on "salt-free" diets consisting largely of milk at first, and later of vegetables, fruit, cereals and, later on, added protein. When figures for the intake are given in the latter cases, they represent approximate values only, obtained by computation of their amounts from tables of normal values and the measurement of the amounts ingested. Blood determinations were usually made when fasting, but in some cases this was impossible and little difference was noted when the venipuncture was nearer a meal time.

METHODS

Blood sodium was determined by the method of Kramer and Tisdall [2] and the chlorides by that of Rappleye.[3] Sodium in the food, feces and urine was determined by the standard gravimetric methods for estimation of potassium and sodium, cobalti nitrite being used instead of platinic chloride for the precipitation of potassium. The sodium values were obtained by deducting the potassium from the total. The urinary

* Received for publication, Feb. 18, 1927.

* From the laboratories of the Subdepartment of Pediatrics, University of Toronto and of the Hospital for Sick Children, and the wards of the Hospital for Sick Children.

1. Boyd, G. L.; Courtney, A. M., and MacLachlan, I. F.: Metabolism of Salts in Nephritis, Am. J. Dis. Child. **32**:29 (July) 1926.

2. Kramer, B., and Tisdall, F. F.: J. Biol. Chem. **44**:3, 1921.

3. Rappleye: J. Biol. Chem. **35**:509, 1918.

chlorides were estimated by Volhard's method. Food and fecal chlorides were also determined by this method after preliminary treatment as outlined by Schloss.[4]

CHLORIDES

In table 1 are given the plasma chlorides expressed in milligrams of sodium chloride per hundred cubic centimeters of plasma found in ninety determinations in sixty-eight cases of all types of nephritis. The chlorides were found to be normal in forty-one cases, or in 46 per cent of these. The abnormal chlorides were about equally distributed between those which were too high, twenty-two determinations, and too low, twenty-seven.

Fifty-two cases of acute glomerular nephritis were studied. In some of these, more than one chloride determination was done. In 80 per cent of these the plasma chlorides were at the upper normal limit or were definitely increased. Hypochloremia was noted only five times. In no case was the low plasma chloride associated with demonstrable edema or with blood dilution. The two patients with the highest chlorides (B. S. and H. S.) had had slight edema, which was subsiding at the time of the test. Hyperchloremia was a little less frequent in hydremic types of acute nephritis, being present in 64 per cent of the cases of acute tubular nephritis, and in 68 per cent of the acute mixed type. Mayrs[5] has referred to this tendency for an increased plasma chloride concentration to occur in acute hydremic nephritis, while Atchley[6] has noted the frequency of hyperchloremia in all types of acute nephritis.

Seventeen determinations of plasma chlorides were made in nine cases of chronic azotemic nephritis. There was noted in all cases a constant tendency for the chlorides to sink to a lower level as the disease progressed. Such depression takes place within a few months in those with a rapidly progressive lesion (P. F.) and is spread over years in the more benign type (I. T., A. T., and G. J.). Isolated determinations in two of these patients (M. W. and M. F.), one uremic and the other with a malignant condition, were within normal range but at its lower level. The absence of edema in all of these patients having hypochloremia and its presence in some of those having normal or high chlorides would suggest some relationship between the two. More intimate knowledge of the cases, however, shows that this was mere coincidence and that the edema and high chlorides were early occurrences in the disease, while

4. Schloss, E.: Monatschr. f. Kinderh. **9**:636, 1911; **10**:499, 1912.

5. Mayrs, E. B.: Quart. J. Med. **19**:273, 1926.

6. Atchley, D. W.; Loeb, R. F.; Benedict, E. M., and Palmer, W. W.: Physical and Chemical Studies of Human Blood Serum, Arch. Int. Med. **31**:611 (April) 1923.

TABLE 1.—*Blood Chlorides in Nephritis*

Name	Age	Chloride (as Sodium Chloride) Mg. per 100 Cc.	Plasma Protein, per Cent (Refractometer)	Per Cent of Corpuscles	Hemoglobin, per Cent	Edema	Weight	Diuresis	Albumin, Gm. per Liter
Acute Glomerular Nephritis									
M. G.	5½	600	....	..	75	0	Stationary	0	0.8
E. B.	14	600	....	..	80	0	Stationary	0	1.5
M. R.	2 wk.	580	....	..	75	0	Stationary	0	+
A. W.	2 wk.	440	....	..	..	0	..	0	++
B. S.	5	770	....	..	..	0	..	0	1.0
R. H. 1.	11	600	....	..	100	Slight	..	0	0.4
R. H. 2.	11	570	....	..	..	0	..	0	0.4
J. C.	1	695	....	..	55	0	..	0	0.5
G. B.	11	415	....	29	60	0	0	0	++
*R. B.	6	640	....	25	50	0	..	0	+
*A. J.	13	700	....	50	85	0	..	0	++
A. L.	8	570	....	41	80	0	Stationary	0	0
H. S. 1.	4	615	7.63	32	85	Slight	..	Scant urine	0
H. S. 2.	4	790	9.99	31.5	85	Slight	..	0	0
P. S.	7½	555	8.06	38	75	0	Stationary	0	++
G. B.	10	505	7.42	35	..	0	..	0	+
A. K.	10	690	7.85	42	..	0	..	0	+
W. V.	10	730	8.07	3	..	0	..	0	Trace
L. M.	7	510	9.35	35	..	0	..	0	+
O. W.	6	465	7.85	39	75	+	+	0	+
Acute Syphilitic Nephritis									
B. R.	6 wk.	410	4.20	30	60	+++	Increased	0	8.0
Cardiorenal Nephritis									
*M. A.	8	550	....	60	75	+++	..	0	++
Pyelitis, Acute Nephritis									
*B. C.	11	630	....	44	68	+++	..	0	..
Pyelonephritis									
A. B.	10½	610	8.06	46	80	0	..	0	Trace
Acute Tubular Nephritis									
J. B.	8	600	....	..	60	Slight	0	0	1.5
P. C.	4	560	....	..	..	Slight	Increased	0	1.0
*E. C.	13	610	....	50	68	++	Decreased	+	Trace
H. F.	4	665	6.98	36	65	+	..	0	Trace
*D. H.	2¼	650	....	50	85	+++	..	0	+++
*A. J.	5	580	....	50	75	0	..	0	+++
N. C. 1.	6	445	7.42	29	..	+++	..	+	+
N. C. 2.	6	480	8.28	26	..	Slight	..	+	0
R. D. 1.	6	615	6.05	29	75	++	..	0	+++
R. D. 2.	6	565	7.20	35	..	Slight	..	0	+
E. R.	7	510	8.06	31	60	0	0	0	Trace
R. B.	20 mo.	615	6.05	29	..	+++	Decreased	0	7.5
A. K. 1.	6	390	3.50	46	..	+++	Stationary	0	+
A. K. 2.	6	520	4.40	48	..	0	Decreased	+	0
F. H.	11	570	6.10	56	..	++	Stationary	0	++
Acute Mixed Nephritis									
M. C.	13	467	....	..	80	+++	..	0	+++
C. C.	11	570	....	..	80	++	Stationary	0	+++
M. B. 1.	8	625	....	..	..	Slight	..	0	3.5
M. B. 2.	8	560	....	..	..	0	..	0	5.0
M. S.	9 mo.	457	....	..	77	+++	..	0	5.0
E. R.	5	550	....	..	..	Slight	Stationary	0	++
*G. B.	11	590	....	27	70	+	Decreased	0	++
R. H.	12	570	6.10	46	75	+	Stationary	0	++
R. C.	8	600	....	..	62	0	..	0	Trace
*R. H.	8	575	....	46	70	0	..	+	++
R. J.	4	555	8.28	30	75	0	..	0	Trace
*G. C.	10	690	....	50	55	0	..	0	+++
J. S.	2	612	8.71	40	55	0	Stationary	0	0
*N. W.	10	620	....	52	75	Slight	Decreased	0	+++
G. S.	12	550	6.77	35	75	Slight	Decreased	0	++
L. S.	4	620	6.55	45	55	Slight	Stationary	0	++++
A. B. 1.	12	632	8.32	22	75	Slight	..	?	+++
A. B. 2 (14 days later)	12	560	6.48	21	..	+++	..	0	+++
A. B. 3 (1 day after 2)	12	505	6.62	13	..	+++	..	0	+++
F. H. 1.	6	510	4.92	34	..	+++	..	0	++
F. H. 2 (10 days later)	6	520	5.08	30	..	0	..	+	+
*J. H.	8	750	....	..	60	0	Decreased	+	+++
P. B.	8	660	5.00	36	75	Slight	Increased	0	+
F. M.	6	420	....	..	70	+++	Stationary	0	7.5
D. L.	6	550	....	79	..	+	Decreased	0	++

TABLE 1.—*Blood Chlorides in Nephritis—Continued*

Name	Diagnosis	Age	Chloride (as Sodium Chloride) Mg. per 100 Cc.	Plasma Protein, per Cent (Refractometer)	Per Cent of Corpuscles	Hemoglobin, per Cent	Edema	Weight	Diuresis	Albumin, Gm. per Liter
	Chronic Parenchymatous Nephritis									
E. L.		17 mo.	565	6.34	36	80	+	Decr. rapidly	+	14.0
N. M.		5	600	....	..	..	++	Incr. rapidly	0	+
*E. D. 1.		8	700	....	50	..	++++	Stationary	0	+++
*E. D. 2.		9	710	5.00	41	..	+	..	0	++
H. D.		6	600	....	37	78	+++	..	0	++
	Chronic Mixed Nephritis									
G. J.		8	685	7.20	44	65	0	Increased	0	++
G. J. 2.		9	600	....	30	90	0	Increased	0	3.5
J. B. 1.		11½	650	5.14	30	65	0	Increased	?	7.0
J. B. 2 (10 days after)		11½	545	7.43	32	65	0	Stationary	0	4.0
M. W.		14	560	....	..	95	Slight	..	Anuria	?
A. W.		10	580	....	..	..	++	Decreased	?	++
A. T. 1.		6	610	5.18	43	80	0	Stationary	0	++
A. T. 2.		7	470	6.34	..	..	0	Stationary	0	++
*D. T. 1.		8½	680	....	35	80	+	Decreased	0	++
D. T. 2.		10½	500	6.55	34	75	0	Stationary	0	4.0
D. T. 3.		11½	430	6.55	60	..	0	Stationary	0	++
P. F. 1.		10	655	6.08	30	..	Slight	Stationary	0	2.0
P. F. 2 (1 mo. after 1)		10	615	6.55	31	..	0	Stationary	0	+++
P. F. 3 (3 wk. after 2)		10	580	....	31	..	0	Stationary	0	++
P. F. 4 (2 wk. after 3)		10	575	6.10	32	..	0	Stationary	0	++
P. F. 5 (3 mo. after 4)		10	540	....	30	..	0	Stationary	0	+
M. F.		11	580	8.28	40	90	0	Stationary	+	+++

* Cases in which total salt metabolism was done.

at the time low chlorides were found, azotemia and high blood pressure were the characteristic symptoms of the disease present. The plasma chlorides in this type of disease would therefore appear to be of some prognostic value whether Veil's [7] contention that they are agonal is justified or not.

Only three patients with chronic parenchymatous nephritis were available for study. Four determinations were made. All these were characterized clinically by the early development of a persistent and marked general edema and little or no nitrogen retention. In two instances, the chlorides were normal and in two high. The fewness of our cases will not permit us to draw conclusions regarding the plasma chlorides in this type of nephritis. Mayr's observations agree with ours, but those of De Wesselow [8] are at variance.

RELATION OF PLASMA CHLORIDES TO EDEMA

One of the earliest and most persistent explanations of the cause of edema has been that it was the result of chloride retention. One of the explanations of this has been the almost constant hyperchloremia found in whole blood determinations and its frequent association with a low urinary output of the salts. More recent studies of blood chlorides.

7. Veil: Biochem. Ztschr. **91**:267, 1918.
8. De Wesselow, O. L. U.: Quart. J. Med. **19**:53, 1925.

done on serum or plasma, have shown this concentration in edema to be variable. Hyperchloremia associated with blood concentration has been noted in certain hydremic cases, especially during the accumulation of fluid, by Nonnenbruch [9] and later by Foder and Fischer.[10] These observers also recorded the disappearance of these phenomena during diuresis. Thannhauser [11] found the increase in blood chlorides but not the anhydremia in his cases. Volhard and Fahr [12] also noted the increased concentration of the blood in the pre-edematous stage of certain types of nephritis.

Chart 1 shows the relationship between the stage of edema and the plasma chloride and protein and the corpuscle content of the blood as found in our cases. It will be seen that during the development of edema, the plasma chlorides are constantly normal or increased. No clear-cut evidence of blood dilution was furnished by our data, the protein being normal and the decrease in cell volume not greater than could be accounted for by the secondary anemia present. After the establishment of the hydremic state, plasma chlorides are found frequently below the normal level. This depression in chlorides was usually associated with hydremia. Two cases showed no decrease in cell content: a cardiorenal case (G. A.) showing cyanosis and the other (D. H.) a case of acute tubular nephritis. As the edema subsided, chlorides were found within the limits of normal in the majority of cases. The protein concentration approached normal, but the corpuscle volume remained persistently low, often for long periods. This return to normality is fairly rapid in most cases.

Chart 2 depicts the relationship found between the degree of edema present and the blood chlorides and dilution. It will be observed that with slight edema or with general edema unaccompanied by ascites there is a constant tendency for the chlorides to be normal or increased. This was surprising, as with one exception these patients all had low blood proteins. Unfortunately, neither cell volume nor protein determinations were done in the case showing hypochloremia (M. Sl.). Low plasma chlorides and blood dilution were found almost constantly in cases showing ascites with their edema. Only two cases of ascites unaccompanied by edema were seen (E. R. and N. W.). Probably both patients had edema before coming under observation, and their normal chloride and blood concentration represents the return to normality.

Little difference is seen in the blood concentration in those cases in which the edema was a part of an acute illness and those in which it

9. Nonnenbruch, W.: Deutsches Arch. f. klin. Med. **122**:389, 1917.
10. Foder, A., and Fischer, C. H.: Ztschr. f. d. ges. exper. Med. **29**:465, 1922.
11. Thannhauser, S. J.: Ztschr. f. klin. Med. **89**:181, 1920.
12. Volhard and Fahr: Die Brightahe Nierenkrankheit, 1921.

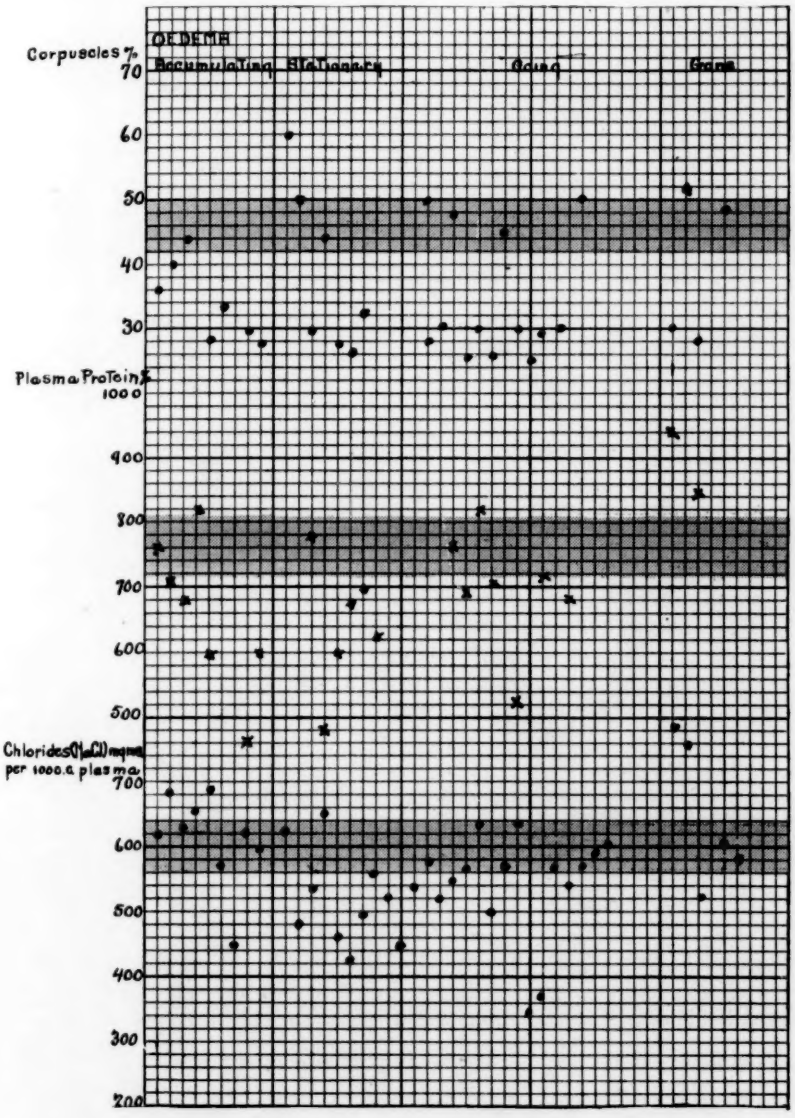

Chart 1.—Relation of plasma chlorides to stage of edema.

was more or less constantly present over long periods. At most, it may be said that hydremia is found more frequently in the chronic cases.

Reference to the examination of the blood in those patients having an edema that "pitted" might be of interest. We have observed this

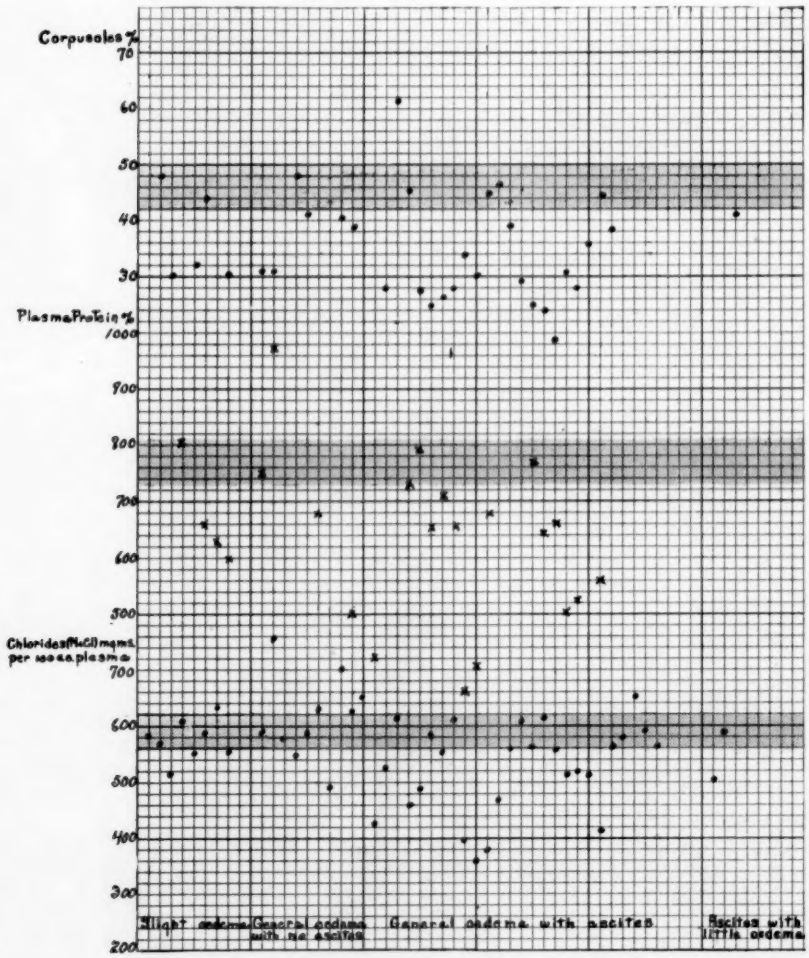

Chart 2.—Relation of plasma chlorides to degree of edema present.

phenomenon infrequently in nephritic children. Seven cases showing three different types of nephropathy are included in this group. The chlorides were always minimal, normal or low, and hydremia was constant, the protein being less than 6 per cent and the corpuscles from 13 to 34 per cent of the blood.

DRY RETENTION OF CHLORIDES

In 1905, Ambard showed that in certain cases of interstitial nephritis with high chlorides, chloride and water retention were dissociated. Such disagreement has been more recently reported by Bickel [13] in cases in which water intake was restricted and its loss increased. Blum and van Caulert [14] have recently reported two such cases and believe the phenomena to be of fairly frequent occurrence in interstitial nephritis, corresponding to the gravity of the condition. The presence of "dry retention" has been detected by these authors by examination of blood chlorides and blood concentration (refractometer). In table 2 are three of our cases that might, according to these observers, be so classified. However, one doubts the value of refractometric readings alone as adequate evidence of blood concentration, in view of the fact that the extremely low corpuscle content indicated rather the reverse. Further, the association of high plasma chlorides with high plasma proteins

TABLE 2.—*Dry Retention of Chlorides*

Name	Plasma Chlorides, Mg. per 100 Cc. (Refractometer)	Plasma Protein, per Cent	Hemoglobin, per Cent	Per Cent of Corpuscles	Edema	Weight	Diuresis	Diagnosis
H. S.	790	9.99	85	32	Slight	Decreasing	?	Acute glomerular nephritis
A. B.	632	8.32	75	22	Slight	.....	+	Acute mixed nephritis
W. V.	730	8.07	..	37	0	Stationary	0	Acute glomerular nephritis

always occurred in the cases of acute glomerular nephritis, only one of which was at all severe, so we were unable to confirm the reports of these authors as to its prognostic value.

RELATION OF PLASMA CHLORIDES TO FUNCTIONAL TESTS

A number of observers have suggested the existence of some relationship between the functional capacity of the kidney and the plasma chlorides. De Wesselow regards hyperchloremia in interstitial nephritis as equivalent to and of the same significance as azotemia and thinks that hypochloremia, when it occurs in a uremic patient, is due to the vomiting. Atchley et al. report low plasma chlorides as occurring constantly in uremia. In table 3 are given the chlorides in seven of our cases showing a blood nonprotein nitrogen of 80 mg. per hundred cubic centimeters or more. No close relationship is demonstrable between the degree of azotemia and the chlorides. The latter were low in all cases whether vomiting or other uremic symptoms were present or not.

13. Bickel, A.: Virchows Arch. f. path. Anat. **227**:108, 1920.

14. Blum, L., and Van Caulert: Bull. et mém. Soc. méd. d. hôp. de Paris **49**:986, 1925.

In twelve cases presenting clinical symptoms of uremia, seven of which were nonazotemic, the plasma chlorides were constantly subnormal, and the degree of their depression was not dependent on the severity of the vomiting.

In twelve patients with a systolic blood pressure between 140 and 215 mg. of mercury, the chlorides were low in all but three. In the latter, edema was disappearing rapidly and some degree of anhydremia

TABLE 3.—*Chlorides in Seven Cases Showing Blood Nonprotein Nitrogen of Eighty Mg. Per Hundred Cubic Centimeters or More*

Name	Plasma Chlorides as Sodium Chloride, Mg. per 100 Cc. of Blood	Nonprotein Nitrogen, Mg. per 100 Cc. of Blood	Creatinine, Mg. per 100 Cc. of Blood
M. N.	550	173	8.0
M. F.	540	100	3.0
F. B.	505	109	4.59
E. R.	550	89	3.0
P. C.	445	82	3.5
G. S.	445	82	4.5
M. B.	560	231	12.06

TABLE 4.—*Blood Sodium in Nephritis*

Name	Age	Mg. of Sodium per 100 Cc. Plasma	Mg. Chloride as Sodium Chloride per 100 Cc. Plasma	Per Cent Corpuscles	Hemoglobin, per Cent	Edema	Weight	Diuresis	Albumin	Diagnosis
R. B.	6	340	640	25	50	0	.....	0	+	Acute glomerular nephritis
A. J.	13	340	700	50	85	0	.....	0	+++	Acute glomerular nephritis
M. A.	8	325	550	60	75	+++	.....	0	++	Cardiorenal
B. C.	11	333	630	44	68	0	Stationary	0	+	Pyelitis
E. C.	13	360	610	50	68	++	Decreased	+	Trace	Acute tubular nephritis
D. H.	2¼	356	650	50	85	+++	.....	0	+++	Acute tubular nephritis
G. B.	11	328	590	27	70	+	Decreased	0	++	Acute mixed nephritis
G. C.	10	346	600	50	55	0	.....	0	+++	Acute mixed nephritis
N. W.	10	330	620	52	75	Slight	Decreased	0	+++	Acute mixed nephritis
E. D. 1	8	351	700	50	..	++++	Stationary	0	++	Chronic tubular nephritis
E. D. 2	9	339	710	41	..	+	Stationary	0	++	Chronic tubular nephritis

was present at the time of the test. This association of low plasma chlorides and high blood pressure occurs independently of the cause or duration of the hyperpiesis.

Renal function tests, including concentrating power, water excretion and diluting power and the phenolsulphonphthalein tests, were done in twenty-five of the cases studied. No close agreement was noted between the response to these tests and the level of the blood chlorides, with the possible exception of the phthalein test. Most patients showing gross impairment in ability to excrete this dye had hypochloremia.

BLOOD SODIUM

In table 4 are given the amounts of sodium found in the blood of eleven of our patients. The general lack of any really satisfactory method for determining this element precluded the amassing of any large number of figures. Denis and Hobson [15] have reported a great increase of this ion in four nephritic patients, three of which had marked edema. Atchley failed to find any constant diminution in uremia. Nine of our eleven cases showed values within normal limits (from 325 to 350 mg. per hundred cubic centimeters). Slight increases were noted in the other two patients, both of whom were edematous. In these cases high chlorides were also present. No relation to the degree of edema present was found in the other nine patients. As pointed out in an earlier paper,[16] the sodium, while not abnormally high, was so near the upper normal level that when its value was added to the potassium values of the same bloods there was produced a slight preponderance of these irritative salts over the more sedative calcium and magnesium salts.

BALANCE EXPERIMENTS

Complete metabolism studies were made in fourteen cases. The results are given in table 5. A positive balance of both sodium and chlorides was present in half of these. In no case did dissociation in the retention of these salts occur. Positive chloride balances were accompanied by high plasma chlorides in all but one case. Vomiting in this case was sufficiently severe to have been a factor in the production of the hypochloremia. Retention of both chlorine and sodium was found in all types of nephritis, but it was not found in any patients who did not have, or had not had, edema. Water retention, often amounting to a third of the fluid intake, was constantly associated with positive balance.

Seven of the cases showed a negative balance of both sodium and chlorine, sometimes associated with water retention of moderate degree. Loss of these salts in excess of the intake occurred in two types of cases: in acute glomerular nephritis with little or no functional impairment (A. J. and B. C.) and during the excretion of edema in more severe cases (A. J., E. C., B. C. and N. W.). Excessive loss of these salts was never accompanied by hypochloremia, but rather by increased blood chlorides which, as pointed out above, is usual in these types of nephropathy.

Diuresis was occurring during metabolism in four cases. In three of these, a negative balance due to an increased loss through the urine was present. Such increased urinary excretion was achieved by polyuria rather than by an increased concentration of the urine in the case of

15. Denis, W., and Hobson: J. Biol. Chem. **55**:183, 1923.
16. Boyd, G. L., and Courtney, A. M.: Am. J. Dis. Child. **32**:192, 1926.

TABLE 5.—*Chloride and Sodium Balance in Nephritis*

Case	Age	Chloride (Cl) (Gm.)					Blood (Mg. of Chloride of Sodium Chloride)	Sodium (Na_2O) (Gm.)					Blood (Mg. of Sodum per 100 Cc.)	Edema	Diuresis	Diagnosis
		Intake	Feces	Absorbed	Urine	Balance		Intake	Feces	Absorbed	Urine	Balance				
R. B.	6	1.0854	0.0607	1.0347	0.9038	+0.1309	640	0.8131	0.0732	0.7399	0.3820	+0.3579	340	0	0	Acute glomular nephritis
Al. J.	13	1.0391	0.0825	0.9566	2.6800	—1.7234	700	0.0842	0.0948	0.5894	2.1607	—1.5713	340	0	0	Acute glomular nephritis
M. A.	8	1.2678	0.0714	1.1964	1.1415	+0.0549	555	0.8600	0.0804	0.7506	0.5930	+0.1866	325	+++	0	Cardiorenal nephritis
B. C.	11	1.5854	0.3735	1.2119	2.0522	—0.8403	630	1.1878	0.4835	0.7043	1.4568	—0.7525	333	0	0	Pyelitis and acute nephritis
A. J.	5	1.4083	0.1009	1.3074	1.5988	—0.2914	580	0.9795	0.1582	0.8213	0.9990	—0.1777	328	0	0	Acute tubular nephritis
E. C.	13	0.9425	0.3544	0.5881	2.1988	—1.6107	610	0.4755	0.4467	0.0288	2.0739	—2.0451	360	++	+	Acute tubular nephritis
G. B.	11	0.4323	0.0132	0.4191	0.2734	+0.1457	590	0.3445	0.0262	0.3183	0.1864	+0.1319	328	+ rapidly going	+	Acute mixed nephritis
B. H.	8	1.5024	0.1125	1.3899	2.1160	—0.7261	575	1.0448	0.1416	0.9032	1.5165	—0.6133	324	0	+	Acute mixed nephritis
G. C.	10	1.1163	0.1486	0.9677	0.7982	+0.1692	600	0.8512	0.2143	0.6369	0.3743	+0.2626	346	0	0	Acute mixed nephritis
N. W.	10	1.1667	0.1377	1.0290	2.3473	—1.3183	620	0.8253	0.0942	0.7311	1.7946	—1.0635	330	Slight clearing	0	Acute mixed nephritis
J. H.	8	0.7817	.....	.....	0.8702	.....	750	0.3994	.....	.....	0.6284	.....	356	0	+	Acute mixed nephritis
I. T.	8½	2.1026	0.1153	1.9873	0.9712	+1.0161	680	2.0042	0.1223	1.8819	0.6199	+1.2620	328	+	0	Chronic mixed nephritis
E. D. 1	8	0.9331	.....	.....	0.4884*	+0.4447	700	0.6144	.....	.....	0.2184	+0.3960	351	++++	0	Chronic parenchymatous nephritis
E. D. 2	9	1.2012	0.0433	1.1579	0.9005	+0.2484	710	1.1449	0.0962	1.0487	0.5304	+0.5181	339	+	0	Chronic parenchymatous nephritis

* Plus feces.

the chlorides. Sodium, on the contrary, was at least in part lost by an increased concentration of the urinary sodium, the concentration of these urines in sodium varying from 125 to 151 mg. per hundred cubic centimeters, as opposed to from 53 to 109 mg. in cases showing a positive balance and in which large amounts of water were not excreted.

Fecal sodium and chlorides were always so small in amount, 0.5 Gm. or less, and were so little affected by varying conditions that their tedious estimation might easily be dispensed with in studies of this kind.

It has been possible to study the urinary excretion of chloride in a much larger series of cases than those in which balance experiments on sodium excretion were feasible. Such studies include daily excretion of chloride, the concentrating power of the kidney for this element, the effect of added salt in the diet and its rate of excretion by McLean's index.

CONCENTRATION OF CHLORIDES IN NEPHRITIC URINE

A number of workers have studied the excretion of chlorides by the nephritic kidney. This interest has been stimulated by the prevalence of the belief in chloride retention as the etiologic factor in the production of nephritic symptoms and the desire to determine the part played by the kidney in producing this retention. The means we adopted were the determination of the total daily excretion of chlorides and the reduction of this amount to concentration in a unit volume. The effect of certain factors on the latter value was then determined.

Keith [17] gives the normal concentration of chloride as sodium chloride in the urine as 1,000 mg. per hundred cubic centimeters. The normal for children would appear to be somewhat lower.

In nine cases of acute glomerular nephritis, in which there was little or no edema, the urinary concentration was always low, from 100 to 250 mg. per hundred cubic centimeters. This was probably due to the low intake on the salt-free diets, usually approximately 2 Gm. a day, and not to some functional impairment of the kidney, as the total daily excretion was usually adequate for the intake. The administration of 5 Gm. of sodium chloride in addition to the ordinary diet resulted in some increase of total amount and concentration, but the maximum obtained was 405 mg. per hundred cubic centimeters, and it was usually several days afterward before all of the added salt was excreted. Frequently, the added salt caused an increase in the amount of albumin in the urine, or even in the return of hematuria. Probably the renal irritation thus indicated was responsible for the impairment in function noted. Urea in addition to salt was added to the diet in two cases. One urine attained a chloride concentration of 240, and the other 400 mg. per hundred cubic centimeters. The higher chloride concentration found in the two cases was felt not to be due to any stimulating action of urea,

17. Keith, N. M.: Ann. Clin. Med. **1**:61, 1922-1923.

but rather to the extremely mild character of the disease. It is even possible that the urea excreted had an antagonistic effect such as Chaussin [18] has noted in his cases, and that a greater concentration would have obtained if chloride alone had been given. Functional tests done in five of these cases showed a practically normal response.

The chloride concentration in four cases of acute tubular nephritis surprised us by being greater than in the acute glomerular type. The usual daily excretion gave a concentration of from 700 to 800 mg. per hundred cubic centimeters of urine. Administration of added salt always produced a marked retention of water together with the reappearance of edema and a fall in the total chloride excretion and concentration to only 225 or 400 mg. per hundred cubic centimeters. In one case there was an immediate rise in concentration to 1,560 mg. per hundred cubic centimeters instead of the usual 800 to 850, but on succeeding days it fell gradually to a minimum of 304 mg. per hundred cubic centimeters. The higher concentration noted in daily urine might not have been obtained if study had been delayed for a longer time after the subsidence of edema. None of these cases studied showed nitrogen retention. One patient responded poorly to the phthalein and concentration tests, but the function of excreting chlorides appeared as good as in the others.

In the seven cases of acute mixed nephritis studied, the concentration of urinary chlorides was closely associated with azotemia rather than with hydremia. As the nonprotein nitrogen of the blood rose the chlorides fell, even though the amount of urine excreted remained fairly constant. One patient who had marked general edema and anasarca and who almost had an anuria showed no trace of chloride in the urine. When the kidney could concentrate well, as measured by a concentration test, the urinary chloride concentration was also good, and vice versa. Response to the water test was not an indication of the ability to excrete chlorides. The response to the ingestion of extra salt was the same as was noted in acute tubular nephritis.

Only two cases of chronic parenchymatous nephritis were studied. Both patients passed small amounts of urine, from 500 to 800 cc. daily, but the urinary chlorides were concentrated to from 400 to 730 mg. per hundred cubic centimeters, although both had marked edema all the time. The usual reaction produced by added salt in hydremic cases occurred; namely, increased edema with water retention and a slow excretion of the added salt.

No cases of chronic azotemic nephritis were studied in this way.

RATE OF EXCRETION OF CHLORIDES IN NEPHRITIS

Some years ago French workers, notably Ambard, and Veil and their co-workers, demonstrated that certain substances, such as urea and chlorides, are excreted by the kidney according to definite laws capable

18. Chaussin, J.: J. de Physiol. et path. Gen. **18**:895, 1920.

of numerical expression. A review of this work has been given by Ambard [19] in his book. These observers found that a practically constant threshold value of 5.62 Gm. of sodium chloride per liter of plasma existed, and that the sodium chloride above this value would therefore determine the rate of excretion. Practically, it appears best to calculate the plasma chlorides from the rate of excretion and to compare this with the actual plasma value. In the simplest form, the formula reads:

$$\text{Plasma NaCl} = 5.62 + \sqrt{\frac{\text{Gm. NaCl per 24 hours} \sqrt{\text{Gm. Na.Cl per 1. of urine}}}{4.23 \times \text{weight in kilograms}}}$$

Assuming that the laws for the rate of excretion remain constant over the threshold, the latter may be obtained from this formula, thus:

$$\text{Threshold} = \text{plasma NaCl} - \sqrt{\frac{\text{Gm. NaCl per 24 hours} \sqrt{\text{Gm. NaCl per 1. of urine}}}{4.23 \times \text{weight in kilograms}}}$$

The constancy of the formula depends on the constancy of the threshold and the constancy of the rate of excretion above the threshold.

TABLE 6.—*Calculated and Actual Plasma Chlorides*

Names	Gm. of Chloride per Liter of Urine	Sodium Chloride Excreted in the Urine in 24 Hours	Gm. Sodium Chloride per Liter of Blood: Calculated	Actual	Difference Between Calculated and Actual	Threshold Actual Formula	$\sqrt{\frac{D. \times C.*}{4.23 \times Wt.}}$	Weight in Kg.
A. J.	0.195	2.68	5.764	7.00	+0.236	6.856	0.144	....
R. B.	1.27	0.903	6.35	6.40	+0.05	5.67	0.73	....
A. W.	0.300	0.0108	5.656	4.40	—1.256	4.364	0.036	2.2
N. M.	0.100	0.0620	5.66	6.00	+0.34	5.96	0.04	23.6
J. B.	3.900	2.800	5.82	5.45	—0.37	5.24	0.2008	31.3
G. B.	0.273	0.610	5.71	5.90	+0.19	5.81	0.09	22.6
I. T.	1.016	1.07	5.725	6.80	+1.075	6.69	0.1055	18.0
W. C.	1.128	3.10	5.845	6.95	+1.105	5.72	0.225	9.5
P. C.	0.840	1.50	5.745	5.60	—0.145	5.47	0.125	15.4
M. S.	0	0	5.62	4.57	—1.05	4.57	0	8.0
E. R.	1.09	1.19	5.63	5.50	—0.134	5.48	0.0144	18.0
M. G.	1.14	0.90	5.73	6.00	+0.266	5.886	0.114	18.0

* D. = Gm. of sodium chloride excreted in twenty-four hours; C. = Gm. of sodium chloride per liter of urine.

McLean [20] confirmed Ambard's observations in normal persons and studied further their applicability to the study of renal function in disease conditions. He concluded that they were suitable for the latter purpose. By comparison of the actual and calculated plasma chloride, changes in the function of their excretion may be studied. Among the pathologic cases were three of nephritis. The actual chlorides were invariably higher than the theoretical chlorides and tended to return to this level as the patient improved. After the recovery of the ability to excrete urea, the theoretical chlorides sometimes rose higher than the actual. This represents a stage of vascular irritability.

19. Ambard: Physiologie Normale et Pathologique des Riens, Paris, 1914.
20. McLean, F. C.: J. Exper. Med. **22**:212 and 366, 1915.

In table 6 are given determinations of this nature in twelve nephritic patients. In seven, the actual chlorides were greater than the theoretical chlorides as found by McLean. The other five patients, including one not showing any urinary chlorides, more closely resembled the pneumonic and diabetic patients studied by McLean, in whom depression of the threshold rather than inability of the kidney to excrete was responsible for the lack of sodium chloride in the urine. Two of these patients with low thresholds (A. W. and M. S.) died within a few days of the tests.

SUMMARY

1. The plasma chlorides in acute nephritis are usually at the upper normal level or are definitely increased. In the acute glomerular type, the chlorides are high in 80 per cent of the cases. Low plasma chlorides in this type of nephritis are rare and occur only in association with persistent vomiting. Increased chloride concentration is also present in more than two thirds of the cases of the acute hydremic character.

2. In chronic azotemic nephritis, the level of the plasma chlorides falls as the disease progresses. Hypochloremia is characteristic of the disease when azotemia and high blood pressure are present and appears to be of some prognostic importance.

3. Plasma chlorides in chronic parenchymatous nephritis may be normal or high.

4. During the accumulation of edema, in all types of nephritis the plasma chlorides are normal or increased, and the blood concentration is apparently normal. Hypochloremia and hydremia characterize the dropsical state when it becomes established. As the edema is excreted, the plasma chlorides return to normal fairly rapidly.

5. In patients having slight degrees of edema and no ascites, the plasma chlorides are normal in spite of a low refractometric index of the serums. Hypochloremia and hydremia are present when ascites complicates general edema.

6. Hypochloremia and blood dilution are constantly present in the pseudo-uremia of acute nephritis.

7. No close relationship exists between the degree of retention of nonprotein nitrogen in the blood and the degree of depression of the chlorides.

8. High blood pressure is usually associated with hypochloremia.

9. The plasma sodium is normal or slightly increased in nephritis, and its level is independent of the type of renal lesion or the presence of edema.

10. Retention of both sodium and chlorine, as measured by balance experiments, occurs in all types of hydremic nephritis. Such retention is

associated with high plasma chlorides unless the latter have been reduced by vomiting.

11. Negative balances of sodium and chlorine occur in acute glomerular nephritis with little or no impairment of renal function, and during the excretion of edema in the more severe nephropathies. The blood chlorides are usually high in these cases.

12. The chloride concentration in the urine was lower in the azotemic types of nephritis than in the hydremic ones. Increased excretion of chlorides with the subsidence of edema is attained by the polyuria rather than by increased concentration in the urine.

13. No consistent relationship exists between the ability of the kidney to concentrate chlorides in the urine and its response to other functional tests.

14. Actual plasma chlorides in nephritis often exceed the theoretical values found by McLean's index.

15. The renal threshold is depressed in some cases of nephritis.

RENAL INFANTILISM

REPORT OF A CASE AND A REVIEW OF THE LITERATURE *

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There is a form of interstitial nephritis that occurs in children and gives rise to dwarfism and frequently to bony deformities. It presents a clinical picture to which the name renal infantilism has been applied. This term has been used in preference to chronic interstitial nephritis or to renal dwarfism, because it directs attention not only to the involvement of the kidney tissue but also to the persistent retardation of development of bony structures. The term chronic interstitial nephritis refers entirely to the renal pathologic change and disregards the dwarfism, which is an essential part of the syndrome. The occurrence of chronic interstitial nephritis in childhood, without dwarfism, is demonstrated by the cases of Greene [1] and Schwarz,[2] whose patients show little or no retardation of growth and no bony deformities. The name renal dwarfism directs particular attention to the smallness of stature and does not emphasize the retardation of development, especially of the secondary sexual characteristics. Hence, renal infantilism has been generally accepted as being the most comprehensive and descriptive term for this condition.

REPORT OF CASE

History.—C. W., a girl, aged 3 years, born of American parents, was admitted to the hospital on Dec. 7, 1925. The chief complaint was weakness, progressively increasing bony deformities and a failure to grow. One of the paternal grandparents had died of chronic interstitial nephritis. Throughout the entire period of gestation the mother was ill and part of the time confined to bed. She suffered irregularly from vomiting, severe epigastric pain and transient amaurosis. According to the family physician, however, she at no time showed an elevation of blood pressure or any albuminuria. The child was delivered spontaneously at term and showed no evidence of cyanosis, hemorrhage, convulsions or infection. The weight at birth was 9 pounds (4,082.33 Gm.).

The first tooth erupted at 6 months; subsequent dentition was slow. At the age of 3 years, only ten teeth were present. At 1 year the weight was 10 pounds (4,535.9 Gm.). The child sat up at 15 months, but she had never been able to stand or walk without support. Growth had always been retarded.

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1. Greene, C. H.: Chronic Diffuse Nephritis in Childhood, Am. J. Dis. Child. **23**:183 (March) 1922.

2. Schwarz, H.: Kidney Disease in Infants and Children, Am. J. Dis. Child. **27**:233 (March) 1924.

At 2 weeks of age the patient began vomiting. This increased in severity and became projectile in type. For this reason, atrophine and later thickened cereal were added to the feedings of breast milk. The vomiting continued, however, irregularly throughout the first year. Profuse sweating, not entirely confined to the head, was present. There were no symptoms suggesting infantile tetany.

Toward the end of the first year, the mother noticed that the infant began to drink large amounts of water and to refuse all foods with the exception of milk. At this time the tongue became swollen and because of this together with a subnormal temperature, thyroid extract was prescribed. This had been continued, with increasing dosage, until one week before admission, when 1½ grains (0.09 Gm.) daily was given.

During the second year the child's condition seemed better. She gained slightly in weight and grew slowly. The excessive thirst and poor appetite, however, persisted. Attempts to substitute solid foods for the milk diet by means of starvation met with failure.

Throughout the year previous to admission, polydipsia had increased. The child drank from 4 to 6 cupfuls of water during the night and even a greater quantity during the day. Polyuria was also pronounced. The height remained stationary. A roentgenogram of the chest showed a slight widening of the upper mediastinal shadow, for which one roentgen-ray treatment of the thymus was given. One year prior to admission a deformity of the wrist developed suddenly, and although a roentgenogram revealed no fracture, the arm was placed in splints for three weeks. Later, other deformities of the bones of the chest, legs and arms were noticed.

An attack of influenzal pneumonia in March, 1925, was complicated by edema and coma for a period of four days, but was followed by rapid recovery.

At the time of the appearance of the bony deformities, the patient was treated for a period of two months with ultraviolet irradiations, and throughout the following summer she was exposed to sunlight for one hour daily. At this time, but unassociated with the treatments described in the foregoing, the skin became darkly pigmented, the color resembling that of a mulatto. This had gradually become less intense. Cod liver oil was given in dosages of ½ teaspoonful at 6 months of age and was increased so that during the second and third years 2 tablespoonfuls were given daily.

Physical Examination.—The child was poorly developed but moderately well nourished and appeared bright and alert. Her weight was 16 pounds 13 ounces (7,632 Gm.), and she was 29 inches (73.6 cm.) in height. The skin was brownish yellow, almost icteric, but the sclerae were clear. She was unable to stand even with assistance. She could form short sentences, was able to express her desires and frequently asked for water, which she drank eagerly. Her mentality seemed normal. She presented many obvious bony deformities. The anterior fontanel was widely open. A rachitic rosary and Harrison's sulcus were present. The left wall of the chest was flattened. The tibiae were bowed anteriorly and the upper extremities showed some lateral bowing of the humeri, as well as enlargement of the lower radial epiphyses. The general musculature was poorly developed and atonic. Kyphosis was present when the child assumed a sitting position. The chest was resonant on percussion, and auscultation of the lung fields revealed nothing abnormal. The heart was normal in size; the sounds were of good quality and no murmurs were present. Examination of the abdomen was entirely negative. The kidneys were not palpable.

Ophthalmoscopic examination showed pronounced hyperopia, with a small nerve head and contracted blood vessels. There were no hemorrhages or evidence of albuminuric retinitis.

Laboratory Examination.—The urine, on repeated examinations, was clear, straw-colored and acid in reaction. The specific gravity was 1.008; there was a trace of albumin but no casts. Tests for sugar were negative. An analysis of the blood showed a serum calcium of 9.6 mg., a serum phosphorus of 7.5 mg., a total nonprotein nitrogen of 107 mg., creatinine, 5.4 mg., uric acid, 8.9 mg., and

sugar, 76 mg. per hundred cubic centimeters of blood. Intramuscular administration of 6 mg. of phenolsulphonphthalein gave 1 per cent excretion during the first hour and 2 per cent during the second hour. A blood count revealed 4,480,000 erythrocytes per cubic millimeter and 11 Gm. (65 per cent) of hemoglobin per hundred cubic centimeters of blood. The white blood count was 10,400 per cubic millimeter, with a differential count of 38 per cent polymorphonuclear cells, 57 per cent small lymphocytes, 1 per cent large lymphocytes, 3 per cent transitional cells and 1 per cent eosinophils.

Roentgenographic examination of the long bones showed a general medullary rarefaction, with acute, rachitic-like epiphyseal changes and periosteal thickening.

The blood pressure was 138, systolic; 72, diastolic. The blood Wassermann reaction was negative. The Pirquet test was negative.

Throughout the stay in the hospital, the condition remained unchanged. There was no elevation of temperature nor other manifestation of an acute infectious process. The polyuria and polydipsia were the outstanding features. The average fluid intake was 37 ounces (1,094 cc.) a day. The urinary excretion could not be satisfactorily measured.

Since the conditions at home were excellent and since there was no indication for hospital care, the child was discharged on the fourth day, to return at a later date for further observation.

Second Admission.—On Feb. 8, 1926, the patient was readmitted for examination. In addition to the previous symptoms, there was a noticeable increase in the deformities of the chest, and genu valgum was present. There had been a gain of only 4 ounces (113.4 Gm.) in weight. The height remained unchanged. The appetite was poor, the patient taking only cereal and milk. Vomiting had increased. The bowels, as a rule, were constipated. The fluid intake, during the stay of four hours in the hospital, was 12 ounces (355 cc.). Analysis of the blood showed the total nonprotein nitrogen still to be 107 mg. and the uric acid to be 5.15 mg. per hundred cubic centimeters of blood. The urine contained an occasional hyaline cast and although the specific gravity was 1.015 there were no other changes. The fundi were the same as on the previous examination.

Two weeks later, a report was received that there had been a sharp elevation of temperature to 106 F., which subsided the following day but which ushered in a short period of minor convulsions, coma and death.

A postmortem examination was not obtained.

REVIEW OF THE LITERATURE

In children, the association of chronic interstitial nephritis with lack of physical development and pronounced rachitic-like bony deformities was first recognized by Goodhart,[3] in 1872. He reported a case in an undersized girl, aged 10 years, who exhibited marked bony changes, polyuria and polydipsia. She suffered from headaches and dyspnea and died in coma. Necropsy revealed a picture of chronic interstitial nephritis. Two years later, Barlow [4] drew attention to the peculiar brownish pigmentation of the skin, so frequently seen in these cases. In 1887, Förster [5] reported the first case in the German literature. This report

3. Goodhart, J. F.: Cyclopedia of the Diseases of Children (Keating) **3**:556, 1872.

4. Barlow, W. H.: A Case of Granular Contracted Kidney (In a Child Five Years, Eleven Months), Lancet **2**:151, 1874.

5. Förster, R.: Ueber Schrumpfniere im Kindersalter, Jahrb. f. Kinderh. **26**:38, 1887.

was followed by two others, one by Oppenheim,[6] in 1891, and another by Hellendall[7] later in the same year. Sequeira,[8] in 1901, reported a case of polyuria in a child of 3 years and gave a good description of renal infantilism, although he probably did not recognize it as a clinical entity. From that time on, descriptions of the syndrome became more frequent, usually appearing, however, as single case reports. Guthrie,[9] Milligan[10] and Sawyer[11] each contributed one. Many of the earlier reports stressed particularly the lesion of the kidney and its manifestations, but in all of them some mention was made of the smallness of stature, malnutrition, poor appetite, peculiar bony changes or delayed mental development. It remained, however, for Fletcher,[12] in 1911, to give the first clear description of this condition. In his report he drew attention to the commoner signs and symptoms and suggested the possibility that the disease of the kidney was congenital in origin. Miller and Parsons,[13] the following year, were able to collect reports of eight cases, one of which had been reported by May[14] and two by Naish[15] earlier in the same year. They attempted to classify these cases according to the degree of accompanying cardiac hypertrophy. During the years from 1911 to 1914, Sutherland[16] reported one case, Zundel,[17] two cases and Barber,[18] three cases.

It is interesting to note that of the fifty-three previously recorded cases, only seven appeared in the American literature. Two of these were contained in the early articles of Goodhart,[19] and the others

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6. Oppenheim, A.: Ueber Schrumpfniere im Kindersalter, Inaug. Dissert. Halle, 1891.

7. Hellendall, H.: Arch. f. Kinderh. **22**:61, 1897 (case 1).

8. Sequeira, J. H.: A Case of Polyuria in a Child, Aged Three Years, Report of the Soc. Stud. Dis. Child. **1**:17, 1901.

9. Guthrie, L.: A Case of Chronic Interstitial Nephritis in Girl Aged Seven Years, Report of the Soc. Stud. Dis. Child. **1**:69, 1901.

10. Milligan, W. A.: A Case of Chronic Interstitial Nephritis in Boy, Age Seven years, Report of the Soc. Stud. Dis. Child. **2**:99, 1902.

11. Sawyer, J. E.: Chronic Interstitial Nephritis in Children, Birmingham M. Rev. **54**:511, 1903 (case 4).

12. Fletcher, M.: A Case of Infantilism with Polyuria and Chronic Renal Disease, Proc. Roy. Soc. Med. (Sect. Dis. Child.) **4**:95, 1911.

13. Miller, R., and Parsons, L.: Renal Infantilism, Brit. J. Child. Dis. **9**:289, 1912.

14. May, O.: Univ. Coll. Hosp. Mag. **2**:99, 1912.

15. Naish, A. E.: Infantilism with Chronic Interstitial Nephritis, Brit. J. Child. Dis. **9**:337, 1912.

16. Sutherland, G. A.: Case of Infantilism, Proc. Roy. Soc. Med. (Sect. Dis. Child.) **5**:3, 1911.

17. Zundel, C. E.: Two Cases of Infantilism, Proc. Roy. Soc. Med. (Sect. Dis. Child) **7**:1, 1913.

18. Barber, H.: Renal Infantilism, Brit. M. J. **2**:1204, 1913.

19. Goodhart, J. F.: Footnote 3. Acute and Chronic Bright's Disease, Cyclopedia of the Diseases of Children (Keating) **3**:541, 1890.

TABLE 1.—*Summary of Clinical and Pathologic Observations in Renal Infantilism*

Case	Author	Sex* and Age†	Weight, Pounds	Height, Inches	Blood Pressure	Bony Deformities: Genu Valgum	Bony Deformities: Others	Polydipsia	Urinary Changes: Polyuria	Urinary Changes: Specific Gravity	Urinary Changes: Albumin	Urinary Changes: Casts	Skin Pigment	Retinal Changes	Manifestations of Uremia	Blood Chemistry	Necropsy Report: Cardiac Hypertrophy	Necropsy Report: Total Kidney Weight Gm.	
1	Parsons: Brit. M. J. **2**: 481, 1911	♀ 6½	—	Size of 3 year old	—	—	—	+	+	1.010	+	Neg.	—	—	—	—	Moderate	29	No atheroma; marked chronic interstitial nephritis; bronchopneumonia
2	Fletcher: Proc. Roy. Soc. Med. **4**: 95, 1911	♂ 6	21	31	75	+	—	+	40-70 oz.	1.005	+	+	—	—	—	—	..	..	Living at time reported
3	Miller and Parsons: Brit. J. Child. Dis. **9**: 289, 1912	♀ 6	At 3 years, 14	36	—	—	—	+	+	—	—	—	+	—	Vomiting; convulsions	—	Slight	29	Chronic interstitial nephritis
4	Miller and Parsons: Brit. J. Child. Dis. **9**: 289, 1912	♂ 9⅛	34	37½	130	+	—	+	40-60 oz.	1.001 1.004	+	+	+	—	—	—	—	..	No necropsy; died of pneumonia
5	Miller and Parsons: Brit. J. Child. Dis. **9**: 289, 1912	♀ 3½	20	—	—	—	—	+	+	1.001 1.004	+	Neg.	+	—	—	—	Moderate	..	Arteries normal
6	May: Univ. Coll. Hosp. Mag. **2**: 99, 1912	♂ 9	—	Size of 4 year old	100/60	—	+	+	23-53 oz.	—	+	+	+	—	—	—	—	—	Living at time reported
7	Naish: Brit. J. Child. Dis. **9**: 337, 1912	♂ 9½	32	40	—	+	+	+	+	—	—	—	+	—	Coma; vomiting; renal suppression	—	Moderate	29	Chronic interstitial nephritis; hypospadia
8	Naish: Brit. J. Child. Dis. **9**: 337, 1912	♂ 16½	—	51	—	+	—	+	+	1.005	+	+	—	—	Dyspnea; renal suppression; stupor	—	Moderate	29	Death postoperative; absence of pubic hair; testes undescended; chronic interstitial nephritis
9	Porter: Arch. Pediat. **32**: 85, 1915	.. 7½	32½	—	—	+	+	+	45 oz.	1.010	+	Neg.	—	—	Vomiting	—	..	..	Living 1 year later; bony changes more marked
10	Porter: Arch. Pediat. **32**: 85, 1915	♂ 6⅛	21	31	—	—	+	—	+	1.009	+	—	—	—	..	—	..	..	Malformation of urethra
11	Fletcher: Proc. Roy. Soc. Med. **13**: 118, 1920	♀ 14	35	Dwarf, appears 5 years old	250/170 175/135	+	—	—	+	1.010	+	+	—	Papilledema; hemorrhages	Convulsions; headache	Urea: 90-168 mg.	Marked	58	No evidence of puberty; sclerosis of vessels; chronic interstitial nephritis; suprarenals enlarged; uterus infantile
12	Evans: Quart. J. Med. **16**: 33, 1923 (case 2)	♂ 14	40½	38¼	195/170 260/200	+	+	—	30-45 oz.	1.012 1.023	—	+	—	Papilledema; hemorrhage	Convulsions; coma	Urea: 67 mg.	Moderate	169	Cerebral hemorrhage and sclerosis; kidney: interstitial changes with tubular and glomerular regeneration

13	Evans: Quart. J. Med. **16**: 33, 1923 (case 4)	♀ 14	—	50	165/123	—	—	—	—	1.008	+	+	+	Hemorrhage	—	Urea: 400 mg.	Slight	92	No pubic hair; chronic interstitial nephritis
14	Paterson: Proc. Roy. Soc. Med **13**: 107, 1920	♂ 11	—	—	—	+	+	+	—	—	—	—	—	—	Convulsions; coma	—	Dilated	..	Death postoperative; kidney small, cystic, fibrotic
15	Paterson: Proc. Roy. Soc. Med. **13**: 107, 1920	♂ 1¾	10½	—	—	+	+	+	—	—	—	—	—	—	Convulsions	—	..	56	Chronic interstitial nephritis; bone showed lack of calcium deposit and osteoblasts
16	Paterson: Proc. Roy. Soc. Med. **13**: 107, 1920	♀ 7½	—	34	—	+	+	—	—	—	+	Neg.	—	—	Suppression; coma	—	..	96	Chronic interstitial nephritis; cystic degeneration; no active bone formation; many fractures
17	Goetsch: Abt's Pediatrics **4**: 757, 1924	♀ 4¾	21½	31½	—	—	+	+	+	1.005 1.010	+	+	—	—	Suppression; convulsions	..	..	..	Living at time reported
18	Hill: Am. J. Dis. Child. **17**: 270 (April) 1919	♂ 7	37	Puny	210/120	—	—	+	+	1.008 1.009	+	+	—	Albuminuric retinitis	Bilious attacks	—	..	..	Living at time reported
19	Sutherland: Proc. Roy. Soc. Med. **5**: 3, 1911	♀ 16	—	Size of 6 year old	120	+	+	+	+	1.000 1.015	Neg.	Neg.	+	Neg.	—	—	..	..	Living at time reported
20	Barber: Quart. J. Med. **14**: 205. 1920	♀ 20	—	12 inches below normal	110	+	—	+	—	1.006	+	—	—	—	—	—	..	..	Living at time reported
21	Barber: Quart. J. Med. **14**: 205, 1920	♂ 15	—	Small	—	+	+	+	50 oz.	1.005 1.010	+	—	—	—	Convulsions; coma	—	..	..	No necropsy
22	Barber: Quart. J. Med. **14**: 205, 1920	♀ 11	—	Small	—	+	—	+	—	1.005	+	—	—	—	Coma	—	Normal	..	Chronic interstitial nephritis
23	Ogilvie: Proc. Roy. Soc. Med. **16**: 51, 1922	♂ 17	—	Appears to be 12	122/70	+	+	—	—	1.009	+	—	—	—	—	Urea: 270 mg.	—	..	
24	Barber: Brit. M. J. **2**: 1204, 1913	♂ 16	—	Undersized	—	+	—	—	—	—	Neg.	—	—	—	—	—	Normal	40	Death postoperative; chronic interstitial nephritis
25	Barber: Brit. M. J. **2**: 1204, 1913	♂ 15	—	9½ inches below normal	Normal	—	—	+	120 oz.	1.003 1.006	+	—	—	—	Coma; convulsions	—	Normal	23	Extreme interstitial nephritis
26	Barber: Brit. M. J. **2**: 1204, 1913	♀ 13	—	9 inches below normal	—	—	—	—	+	1.004	+	—	—	—	Coma; convulsion	—	—	..	Died 1 year later; no signs of puberty; no necropsy
27	Barber: Lancet **1**: 142, 1918	♂ 16	—	16 inches below normal	100	+	—	+	51 oz.	1.005	+	—	—	—	—	—	Normal	..	Chronic interstitial nephritis
28	Barber: Lancet **1**: 18, 1920	♂ 16	—	52	100	+	+	+	41 oz.	1.006	+	—	—	—	—	—	—	..	Not reported

* In this column and in tables 2, 3 and 4, ♂ indicates male; ♀, female.
† At time reported.
‡ Necropsy report by Evans: Quart. J. Med. **16**: 33, 1923.

TABLE 1.—*Summary of Clinical and Pathologic Observations in Renal Infantilism—Continued*

Case	Author	Sex and Age	Weight, Pounds	Height, Inches	Blood Pressure	Bony Deformities: Genu Valgum	Bony Deformities: Others	Polydipsia	Urinary Changes: Polyuria	Urinary Changes: Specific Gravity	Urinary Changes: Albumin	Urinary Changes: Casts	Skin Pigment	Retinal Changes	Necropsy Report: Manifestations of Uremia	Necropsy Report: Blood Chemistry	Necropsy Report: Cardiac Hypertrophy	Necropsy Report: Total Kidney Weight Gm.	
29	Barber: Lancet **1**: 18, 1920	♀ 13¼	—	45	90	+	+	—	—	1.004	+	—	—	—	Coma	—	Normal	29	Chronic interstitial nephritis
30	Barber: Lancet **1**: 18, 1920	♀ 13	—	52	100	+	+	+	50 oz.	1.008	+	—	—	—	—	—	—	..	
31	Paterson: Proc. Roy. Soc. Med. **15**: 81, 1921	♂ 6	—	35	100	+	—	—	—	1.004 1.014	+	—	—	Neg.	—	—	—	..	Living at time reported
32	Page: Proc. Roy. Soc. Med. **14**: 89, 1920	♀ 7½	31½	42	—	+	+	—	50 oz.	1.015	+	—	+	Neg.	Vomiting; drowsy	Urea: 143-147 mg.	—	..	Living at time reported
33	Zundel: Proc. Roy. Soc. Med. **7**: 1, 1913	♀ 13	38½	42	110	—	—	—	+	1.004	+	+	+	Neg.	—	—	—	..	Living at time reported
34	Paterson: Brit. J. Child. Dis. **18**: 186, 1921	♀ 4½	—	23½	95	—	+	—	+	1.006 1.008	+	Neg.	+	—	—	Urea: 108 mg.	—	..	Living at time reported
35	Sawyer: Birmingham M. Rev. **54**: 511, 1903 (case 4)	♂ 2½	15½	—	—	—	+	+	33 oz.	1.002	+	Neg.	—	—	Vomiting; convulsions	—	—	48	Fibrotic overgrowth with diminution of kidney tissue
36	Förster: Jahrb. f. Kinderh. **26**: 38, 1887	♂ 9½	39	Underdeveloped	—	—	—	+	60-125 oz.	1.004 1.010	+	—	—	—	—	—	—	..	Contracted pale cirrhotic kidney
37	Feiling and Holyoak: Proc. Roy. Soc. Med. **15**: 1, 1921	♂ 12½	57½	43½	95/70	+	+	—	26-40 oz.	1.012	+	+	—	Primary optic atrophy left; paleness of right disk	—	—	—	..	Living at time reported
38	Sequeira: Report of the Soc. Stud. Dis. Child. **1**: 17, 1901	♂ 2⅝	16¾	—	—	—	+	+	36-47 oz.	1.005 1.010	+	+	—	Negative	Coma	—	Slight	..	Kidney granular, large, cirrhotic
39	Still: Common Disorders and Diseases of childhood, 1924, p. 598	♂ 5½	—	34¾	—	+	—	+	+	—	+	—	—	—	—	—	—	..	Not reported
40	Still: Common Disorders and Diseases of Childhood, 1924, p. 598	♂ 6	—	35½	—	+	—	—	—	1.004	+	—	—	—	—	—	—	..	Not reported
41	Author's case	♀ 3	16¾	29	138/72	+	+	+	+	1.008	+	+	+	Hyperopia; no hemorrhage; no edema	Coma; convulsion	Nonprotein nitrogen, 107; uric acid, 8.9; creatinine, 5.4	—	..	No necropsy
42	Lathrop: Arch. Int. Med. **38**: 612 (Nov.) 1926	♀ 15	73¼	55½	110/60 150/80	+	+	+	+	1.008 1.009	+	Neg.	+	Negative	Coma; dyspnea	Nonprotein nitrogen, 96-244; creatinine, 7.3; uric acid, 5.3	None	75	Breasts small; absence of pubic hair; chronic interstitial nephritis

TABLE 2.—*Cases of Renal Infantilism in which Clinical or Pathologic Observations are Incomplete*

Case	Author	Sex and Age	Weight, Pounds	Height, Inches	Blood Pressure	Bony Deformities: Genu Valgum	Bony Deformities: Others	Bony Deformities: Polydipsia	Urinary Changes: Polyuria	Urinary Changes: Specific Gravity	Urinary Changes: Albumin	Urinary Changes: Casts	Skin Pigment	Retinal Changes	Manifestations of Uremia	Necropsy Report: Blood Chemistry	Necropsy Report: Cardiac Hypertrophy	Necropsy Report: Total Kidney Weight Gm.	
1	Barlow: Lancet **2**: 151, 1874	.. 6	—	Delicate	—	—	—	+	+	1.010 1.015	+	—	+	—	Vomiting; convulsions; headache	—	Slight	36	Kidney cortex thin, hard, granular; tubules compressed
2	Kendall: Proc. Roy. Soc. Med. **16**: 20, 1922	♀ 4½	32½	36	80/55	+	+	—	+	—	+	—	—	—	—	Urea: 11.5 mg.	..	..	Living at time reported
3	Roth: Proc. Roy. Soc. Med. **16**: 45, 1922	♀ 13	—	—	—	+	+	—	—	1.005	+	—	—	—	—	—	..	..	Operated on without any uremic manifestations
4	Zundel: Proc. Roy. Soc. Med. **7**: 1, 1913	♂ 13	29½	42	100	—	+	+	+	1.000	Neg.	Neg.	—	—	—	—	..	..	Father and brother similarly affected but no stunting; diagnosed diabetes insipidus
5	Hellendall: Arch. f Kinderh. **22**: 61, 1897	♀ 2	—	Backward in development	—	—	+	+	—	—	—	—	—	—	Vomiting	—	Normal	12	Chronic interstitial nephritis
6	Oppenheim: Inaug. Dissert. Halle, 1891	♂ 4	21 26	—	—	—	+	+	+	—	—	—	—	—	Coma; vomiting	—	Normal	92	Chronic interstitial nephritis
7	Glaser: Jahrb. f. Kinderh. **87**: 95, 1918	♀ 10	—	Great developmental retardation	100	—	—	+	66 oz.	1.005	+	+	—	Albuminurie retinitis	—	—	Slight	..	Death from diphtheria; kidneys typical; chronic interstitial nephritis
8	Goodhart: Keating's Cyclopedia of Diseases of Children **3**: 541, 1890	♂ 6	31½	Underdeveloped	—	—	—	+	—	1.005	+	+	—	—	Convulsions; vomiting	—	..	..	Chronic interstitial nephritis
9	Goodhart: Keating's Cyclopedia of Diseases of Children **3**: 556, 1872	♀ 10	—	Small	—	+	+	+	+	—	—	—	—	—	Convulsion; dyspnea	—	Slight	..	Chronic interstital nephritis
10	Guthrie: Report of the Soc. Stud. Dis. Child. **1**: 69, 1901	♀ 7¼	—	Undersized	—	—	—	+	14/84 oz.	1.010	+	+	+	—	Coma	—	..	141	Intracranial hemorrhage; kidney cortex atrophic, diffuse, interstitial cirrhosis
11	Milligan: Report of the Soc. Stud. Dis. Child. **2**: 99, 1902	♂ 7	—	Underdeveloped	—	—	—	+	70 oz.	1.006	+	+	+	Albuminurie retinitis	Coma; suppression	—	Moderate	..	Chronic interstitial nephritis
12	Henderson: Glasgow M. J. **99**: 370, 1923	♀ 10	28½	Poorly developed	250/180	—	—	—	—	1.015	+	—	—	—	Vomiting; convulsions	—	Moderate	..	Arteriosclerosis; chronic interstitial nephritis

included case reports by Porter,[20] Hill,[21] Lathrop [22] and Goetsch.[23] The cases of Green [1] and Schwarz [2] have not been included in this series because they apparently show no evidence of infantilism. English authors have contributed 80 per cent of the published cases. Whether it may be assumed from this that the condition has been most prevalent in Great Britain is questionable. During the past six years, twenty-four such cases have been reported.

ETIOLOGY

The cases are fairly evenly divided between the sexes, twenty-seven occurring in males and twenty-five in females, while no mention is made of the sex in two other reported cases. Because of the difficulty of early diagnosis, the ages of the patients at the time of onset are rarely established. A majority of the patients are between 3 and 10 years of age when the condition is first recognized. Syphilis is considered by a number of the earlier authors to play an important rôle, but this would seem to be unlikely, since the reported blood Wassermann reactions are negative in eighteen patients, positive in only two and doubtful in one other patient. There is no evidence that suggests a congenital syphilitic infection in the remaining thirty-three patients in whom blood Wassermann tests were not made.

There is no familial tendency to kidney disease, and in only one instance, reported by Barber,[18] did more than a single case occur in one family. A history of prenatal maternal illness is obtained in only two cases.

Infection undoubtedly plays the major rôle, although the primary focus or the time of onset of the renal lesion has not been definitely established in any case. Fletcher [12] is of the opinion that this type of infantilism, whether associated with or resulting from chronic renal disease, dates from intra-uterine existence. The occurrence of early renal infections has been confirmed by Karsner,[24] who found chronic parenchymatous nephritis in an infant dying forty-five minutes after birth. The disease of necessity must have been of intra-uterine origin.

Parsons [25] and others believed the disease to result from a toxemia acting during early life. Numerous theories are advanced to explain the infantilism, as well as the nephritis, but none as yet has been generally accepted.

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20. Porter, L.: Renal Infantilism, Arch. Pediat. **32**:85, 1915.
21. Hill, W.: Studies in Nephritis of Children, Am. J. Dis. Child. **17**:270 (April) 1919.
22. Lathrop, F. W.: Renal Dwarfism, Arch. Int. Med. **38**:612 (Nov.) 1926.
23. Goetsch, E.: Abt's Pediatrics, Philadelphia, W. B. Saunders Company **4**:757, 1924.
24. Karsner, H. T.: Congenital Nephritis, Proc. Path. Soc. **12**:16, 1909.
25. Parsons, L.: Infantilism Associated with Chronic Interstitial Nephritis, Brit. M. J. **2**:481, 1911.

SIGNS AND SYMPTOMS

It is possible to divide all signs and symptoms into two groups: First, those referable to physical development and second, those referable to altered kidney function. Under the first heading may be grouped abnormalities in height, weight, bony structure and mental development. The outstanding features under the second division are polydipsia, urinary changes, cardiovascular lesions, gastro-intestinal disturbances, retinal changes, skin pigmentation and alterations in the blood chemistry.

Height.—The retarded development, as exemplified by the cessation or diminution of the normal rate of growth, is a characteristic feature

TABLE 3.—*Comparison of Weight with Normal for Age*

Age*	Sex	Normal Weight†	Actual Weight	Pounds Underweight
6 years	♂	48	21	27
3 years	♀	30½	14	16½
9 years	♂	64	34	30
3½ years	♀	32½	20	12½
9 years	♂	64	32	32
7 years	♀	50	32½	17½
6 years	♂	48	21	27
14 years	♀	109	35	74
14 years	♂	108	40½	67½
21 months	♂	25¾	10½	15¼
4 years	♀	34	21½	12½
7 years	♂	53	37	16
7 years	♀	50	31½	18½
13 years	♀	97	38½	58½
10 years	♀	70	28½	41½
2½ years	♂	29½	15½	14
9 years	♂	64	39	25
2 years 10 months	♂	31½	16¾	14¾
3 years	♀	30½	16¾	13¾
4 years	♀	34	32½	1½
13 years	♂	93	29½	63½
4 years	♂	30	20	10
6 years	♂	48	31½	16½
12 years	♂	85	57½	27½
15 years	♀	119	73¼	45¾

* Over four years the fraction of a year is disregarded.
† The average weight within the normal range.

of this disease. In many cases the smallness of stature is the complaint for which the child is brought under medical observation. The average height of the twenty-eight patients in whom measurements are recorded is 24.2 per cent below the standard normal figures as published by the American Child Health Association and the Children's Bureau, United States Department of Labor. This pronounced dwarfism confirms the idea expressed by Fletcher [26] that "The degree of dwarfism which is seen in cases of this type of renal disease in children is much more marked than any other form of infantilism we come across."

Weight.—Closely paralleling the lack of growth is a corresponding retardation of increase of weight. Using the standards described in the

26. Fletcher, M.: Case of Renal Infantilism, Proc. Roy. Soc. Med. (Sect. Dis. Child.) **13**:118, 1920.

foregoing, the weight in twenty-five cases averages 45.2 per cent below the figures for their respective ages. A comparison of weight with height rather than weight with age, however, yields a figure averaging less than 3 per cent below the normal in the fourteen cases in which both height and weight are recorded. Thus there appears to be no actual malnutrition, the rate of weight increase being directly proportional to the rate of growth.

Bony Changes.—Because of the similarity of the bony changes, these cases are frequently mistaken for the late type of rickets. By far the most common deformity is that of genu valgum, occurring in 56 per cent of the patients. Less frequently are seen enlargements of the costochondral junctions, Harrison's sulcus, enlarged epiphyses and bowed tibias. In view of these bony deformities, the patients are

TABLE 4.—*Comparison of Weight with Normal for Height* *

Sex	Height, Inches	Normal Weight for Children of This Height, Pounds	Actual Weight, Pounds	Overweight, Pounds	Underweight, Pounds
♂	31	24	21	—	3
♂	37½	32⅜	34	1⅝	—
♂	40	36	32	—	4
♂	31	24	21	—	3
♂	38¼	34	40½	6½	—
♀	31½	23¾	21½	—	2¼
♀	41	37	35½	—	1½
♀	42	39	31½	—	7½
♀	42	39	38½	—	½
♀	29	21	16¾	—	4¼
♀	36	30	32½	2½	—
♀	42	39	29½	—	9½
♂	43½	42½	57½	15	—
♀	55½	77	73¼	—	3¾

* A review of this table will show that the marked undernourishment so evident in table 3 is one of lack of development rather than a true malnutrition.

occasionally operated on by orthopedic surgeons, with distastrous results. The causes of these changes have not been satisfactorily explained. Paterson [27] has expressed the opinion that they are nutritional in origin. Porter [20] draws attention to the fact that the appearance of the bony changes seems to express the beginning of the final stage of the disease.

Mental Development.—The earlier authors consider that there is pronounced mental retardation. Both Parsons [25] and Miller [13] believe that the mental development corresponds to stature rather than to age. The more recent observers, however, make little mention of the mental status, the concensus being that up to the age of puberty the mental faculties are normal, but that with the retarded development of the secondary sexual characteristics there is a tendency to mental sluggishness.

27. Paterson, D. H.: Three Cases of Renal Dwarfism Associated with Curious Bony Changes, Proc. Roy. Soc. Med. (Sect. Dis. Child.) **13**:107, 1920.

Polydipsia.—Polydipsia is often the initial symptom. It frequently manifests itself at the time of weaning, increasing in severity as the disease progresses. Quantitative measurements of the daily fluid intake have not been recorded in many cases. Such statements as "always thirsty," "a great water drinker," "excessive thirst" or "intense thirst" are frequently noted. In one instance a 6 year old boy is reported as drinking 70 ounces (2,070 cc.) a day.

Urinary Changes.—As might be expected, an excessive output of urine accompanies the increased fluid intake. A daily output of from 1,200 to 3,700 cc. is not uncommon. Enuresis, even in older children, is often present, while nocturia is almost invariably the rule. The specific gravity of the urine is low—from 1.000 to 1.015. Albumin may usually be found at some stage of the disease, and repeated examinations will show hyaline or granular casts at one time or another. Uremia, with its usual manifestations, is often preceded by urinary suppression and is of grave significance.

Cardiovascular Lesions.—Miller and Parsons [13] attempt to classify all cases according to the degree of existing cardiac hypertrophy. Because of the difficulty of establishing a fixed standard and because of the limited value of any such classification, it has been discarded. Barber [28] finds the cardiovascular lesions in his patients to be slight and the hemomanometer readings normal. Nevertheless, some moderate degree of cardiac hypertrophy, especially of the left ventricle, is usually present. Arteriosclerosis, although limited to the larger vessels, has been found in 10 per cent of the patients coming to necropsy. Hill [21] claims that the blood pressure is always elevated, but hypertension has been noted in only seven of the twenty-five patients in whom measurements have been reported. It is therefore of little diagnostic importance. In general, the vascular changes are much less pronounced than those found in adults with a similar degree of renal involvement.

Gastro-Intestinal Disturbances.—By far the commonest disturbance is the tenacity with which these children cling to the infantile type of diet. Milk and fluids alone seem to be well tolerated and are the foods of choice. Repeated attempts to encourage the taking of a mixed diet, even by withholding milk over a variable length of time, are reported as ending in failure. Periodic attacks of vomiting are frequently seen. Diarrhea is less common than might be expected. Attacks of anorexia, accompanied by abdominal pain, are not infrequent.

Retinal Changes.—Papilledema and albuminuric retinitis or hemorrhage are the usual abnormalities, although not infrequently the fundi appear normal. In some cases the blood vessels are small and the

28. Barber, H.: The Bone Deformities of Renal Dwarfism, Lancet **1**:18, 1920.

fundus congested. Sight does not seem to be greatly impaired, except in the cases showing hemorrhage. Feiling and Holyoak [29] present one case with primary optic atrophy.

Skin Pigmentation.—At some time during the disease, the skin is apt to assume a dirty, yellowish brown pigmentation. This varies in intensity from time to time and has not always the same distribution. Usually it is most marked on exposed surfaces. The sclerae are not affected. The texture of the skin changes also, becoming dry, coarse and inelastic. The mucous membranes are pale. The hair may become dry and scant. Edema, when it occurs, which is rarely, is terminal and accompanies other uremic manifestations.

Blood Chemistry.—In only eight cases is there any record of analyses of the blood. In most of these the urea content only is reported. The values range between 11.5 mg. and 400 mg., with an average of 140 mg. per hundred cc. of blood. Further examination would presumably show a similar elevation of the nonprotein nitrogen, uric acid and creatinine content. Lathrop [22] has made a most complete study of the blood in his case.

PATHOLOGY

Postmortem examinations are reported in 54 per cent of the cases. The kidneys are generally diminished in size. With an average age, at the time of death, of 8¾ years, the combined weight of both kidneys averages 60.1 Gm. The capsule strips with some difficulty, exposing a rough, granular surface. On section the tissue is firm and cuts with resistance. The cortex is poorly defined and quite narrow. Microscopic examination shows proliferation of the endothelial cells of Bowman's capsule, with slight obliterative endarteritis and diminution in the size of the tufts. Diffuse round cell infiltration, with overgrowth of fibrous tissue, is characteristic of the medullary portion. Many of the tubules are tortuous and compressed. Some, however, are dilated and contain hyaline casts. The general picture is that of advanced chronic interstitial nephritis.

The bones, at necropsy, show practically no signs of active ossification, the reverse rather being true. Decalcification is present in all the diaphyses, giving a wooly, almost transparent appearance in parts. The epiphyseal line is thickened and irregular. Fractures are often found in the diaphysis close to the epiphyseal line. On section, in the region of the epiphysis, there are many trabeculae, but the deposition of lime salts and the presence of bone cells are almost negligible. Some distance from the epiphyseal area these intertrabecular spaces begin to be occupied by the normal type of fat marrow.

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29. Feiling, A., and Holyoak, W. L.: Case of Renal Dwarfism with Optic Atrophy, Proc. Roy. Soc. Med. (Clin. Sect.) **15**:1, 1921.

The heart, in fourteen cases, shows a variable degree of hypertrophy, affecting chiefly the left ventricle. In one other instance there is dilatation without hypertrophy. In only three patients is there reported marked atheromatous changes in the vessels. Intracranial hemorrhage is reported as responsible for the death of two patients.

Fig. 1.—Appearance of infant at the time of the first admission, showing the deformities of chest, arm and leg.

Fig. 2.—The rachitic-like epiphyseal changes and periosteal thickening found on admission.

Fig. 3.—The bowing of the tibia and fibula as well as the epiphyseal irregularity present on admission.

PROGNOSIS

Guthrie [9] believes that although the interstitial nephritis may originate in early childhood or even in infancy, it may not prove fatal for many years. Even though such is the case, the ultimate outcome is certain. Whether death occurs during the first few years or whether life is sustained until past puberty depends on the rapidity of progress of the kidney lesion. An acute infection will frequently hasten the end.

The appearance of bony deformities is usually a grave omen and is followed shortly by edema, convulsions or coma and death. The average duration of life after the appearance of these deformities is less than two years.

SUMMARY

Chronic interstitial nephritis in young patients may be accompanied by marked infantilism and rachitic-like bony deformities.

The cardinal symptoms present in these cases of renal infantilism are referable to retarded development and to the renal pathologic change.

Pathologic examination shows a chronic interstitial nephritis, a moderate degree of cardiac hypertrophy, with relatively little arteriosclerosis and a general decalcification of the long bones with a tendency to fracture and deformity.

CHRONIC INTUSSUSCEPTION

AN UNUSUAL TYPE WITH PROLAPSE *

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In a careful review of the literature covering the past sixty years or more, we were impressed by the rarity of a peculiar type of intussusception which had prolapsed through the anus. This condition may be referred to as prolapsus intussuscepti, a type of intestinal invagination wherein a part of the intussusceptum prolapses for a variable distance beyond the anus. We have been unable to find a well-authenticated, detailed report of such a condition in any of the standard textbooks of pediatrics and surgery, and the few reports that we have found in the literature are casual and lack details of description and discussion. There are only seven such cases on medical record from 1870 up to the present, and two of these are in adults.

REVIEW OF THE LITERATURE

W. W. Keen,[1] in his Jacksonian Prize Essay on intestinal obstruction, says, ". . . and the invagination is pushed farther and farther until the rectum is reached, where it may even protrude from the anus, . . . and in at least one instance it has been excised in mistake for a polypoid growth." Pfaundler and Schlossmann[2] state: "In extreme cases the invagination may go on; the intussusceptum proceeds down the colon and the rectum and may be felt in the latter like a portio uteri, finally it may even prolapse through the anus, and the whole colon may come down as a prolapse at the apex of which we observe the invaginated ileocecal valve." Garrod, Batten and Thursfield[3] maintain that "in cases with the long mesentery to the large intestine the intussusception may have prolapsed so far as to be hanging between the knees of the patient." Reference is also made to this condition by Griffith,[4] who says, "The protruding of the intussusception from the rectum, accompanied by straining and the passage of mucus, may sometimes strongly suggest the

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1. Keating: Cyclopedia of Diseases of Children **3**:251, 1891.
2. Pfaundler and Schlossmann: The Diseases of Children (Shaw and LaFetra) **5**:274, 1912.
3. Garrod, Batten and Thursfield: Diseases of Children, 1913, p. 174.
4. Griffith, J. P. C.: The Diseases of Infants and Children **1**:789, 1920.

prolapse of the rectum." More recently, Thomson [5] writes that in acute intussusception "occasionally the invaginated bowel is protruded through the anus." In a recent French publication,[6] the belief is expressed that both colic and ileocecal types of intussusception may reach and pass beyond the anus. From statements such as these, we gather that this condition is occasionally seen, but the fact that none of them are accompanied by detailed description or case reports shows that the condition is rare and the knowledge of it somewhat limited.

In many of the published statistical studies, in which a fairly representative number of cases of acute and chronic intussusception are reviewed, cases of prolapsed intussusception, acute or chronic, are seldom found. Pilz,[7] in his tabulated review of 162 cases, fails to find a single case. Likewise, Hess [8] mentions chronic intussusception, but nowhere does he make note of prolapsed intusussuception in the reports of the 1,028 cases that he had collected. Gibson,[9] in his exhaustive review of 239 cases gathered from the world's literature, mentions only two in which the intussusception was prolapsed, and both of these were in adults, one 36 and the other 44 years of age. Harrison Cripps [10] reported a case in an infant, 7 months old, with a gangrenous intussusception which hung outside the anus. In this case large portions of the bowel sloughed off, and the child finally recovered. However, postmortem examination following death due to scarlet fever showed complete disappearance of the large bowel, the small intestine being attached to the anus. This is the earliest reported case of prolapsed intussusception in infants under 1 year of age that we were able to find in our review of the literature. Clubbe,[11] in his monograph on the subject, tabulates 144 cases, of which only one (case 82), in an infant, aged 4 months, showed "much prolapse of the intestines." The intussusception in this case proved to be ileo-cecal in type, and the condition was reduced with much difficulty twenty-six hours after the onset of the first symptoms. Southam and Crawshaw [12] reported another case in a child, aged 6 months. The prolapse in this case measured 7 inches (17.78 cm.), the

5. Thomson, J.: Clinical Study and Treatment of Sick Children, 1921, p. 271.

6. Precis clinique et operatoire de chirurgie infantile, Paris, 1923, p. 605.

7. Pilz, C.: Zür Invagination im kindlicher Alter, Jahrb. f. Kinderh. **3**:6, 1870.

8. Hess, J. H.: Intussusception in Infancy and Childhood, with Collection of One Thousand and Twenty-Eight Cases, with Statistics, Arch. Pediat. **22**:655, 1905.

9. Gibson, C. R.: Mortality and Treatment of Acute Intussusception, with Table of Two Hundred and Thirty-Nine Cases, M. Rec. **52**:73, 1897.

10. In Keating: Cyclopedia of Diseases of Children, 1891.

11. Clubbe, C. P. B.: The Diagnosis and Treatment of Intussusception, Edinburgh and London, 1907.

12. Southam, A. H., and Crawshaw, C. H.: Resection of Intestine for Acute Intussusception, Brit. M. J. **1**:266 (Feb. 19) 1921.

distal 3 inches (7.6 cm.) of which were gangrenous and could not be reduced, so that the protruding mass had to be resected. Recently, Vickers [13] published a brief description of an infant, 10 months old, who was successfully operated on for intussusception seven days after the first appearance of the prolapse.

In approximately 31,000 patients admitted to the Children's Memorial Hospital, Chicago, from Jan. 1, 1910, to Jan. 1, 1924, less than one tenth of 1 per cent., or 30 cases, were diagnosed as intussusception. Of these, one case only, which we report here, showed a prolapse.

REPORT OF CASE

A. S., a German-American boy, born Jan. 29, 1923, had been breast-fed, and was admitted to the service of Dr. Joseph Brennemann on Oct. 12, 1923, with the following chronological history and course: On Sept. 10, 1923, the child, who had previously suffered from "indigestion," from the age of 3 months and who had been chronically constipated, was seized by sudden pain with doubling up, followed in one-half hour by bloody slime from the rectum and greenish yellow vomiting. The symptoms continued with lessening severity for from six to seven days, while the child continued to nurse from the breast. The stools varied from "green to red to black."

On September 16 a relapse occurred, characterized by bloody stool, vomiting and apparently extreme pain on defecation. Medical treatment was followed by slight improvement.

On September 21 a second prolapse occurred; the child became feverish, apparently for the first time. A mass protruded for the first time from the rectum for 1½ inches (3.77 cm.) and was reduced by a doctor. It soon came down again and was reduced by the child's mother, while the child laughed and played. He improved somewhat until September 26, when he became acutely ill again. The mass came down for the third time and was reduced with great effort, but only for a short while, and remained down most of the time until the day of admission. The child strained and forced it out whenever it was replaced. Breast feeding was supplemented by oatmeal gruel and condensed milk (the exact formula was not given), and the bloody stools continued until Oct. 7, 1923, when the stools became normally yellow and remained so more or less constantly until admission to the hospital. At this time the prolapse was 5 inches (12.7 cm.) long and had been down continuously for at least ten days. Physical examination at 1 p. m. disclosed the following: Temperature, 99.6 F., pulse, 92. The patient, aged about 8 months, was poorly nourished and acutely ill, with dry skin and poor tissue turgor and was apparently in great pain. His eyes rolled upward, the skin was dry and wrinkled, and he was sucking the thumb continuously. A palpable tumor of indefinite outline, which "rolled" slightly under the finger, was felt in the upper left quadrant of the abdomen, extending to the right transversely almost to the midline. A brownish red, sausage-like mass with numerous ring-like depressions, about 5 inches long and nearly 2 inches (5 cm.) in diameter, protruded from the rectum (fig. 1). Digital examination revealed a somewhat lax sphincter with a normal rectal wall as far as the finger could reach. The mass was apparently obturated through the sphincter, thus ruling out simple prolapse of the rectum. Examination was otherwise essentially negative. A diagnosis was made of intussusception with prolapse.

13. Vickers, W.: Diagnosis of Intussusception, M. J. Australia **2**:208 (Aug.) 1926.

The bowel was replaced as in the reduction of a simple prolapse, and an attempt made to keep it in place with strongly reenforced adhesive strips. This, however, was ineffective, and the mass emerged in a short time, coincident with increasing signs of intoxication.

Operation was performed by Dr. J. A. Graham of the attending surgical staff on the same day at 7 p. m. An upper left rectus incision was made under procaine anesthesia (ether had to be used after the peritoneum was opened). A slight amount of free fluid escaped, and a large boggy intussusception, extending from the hepatic flexure to the anus and out, was disengaged with great difficulty. Thrombosis of the small mesenteric vessels was evident in one or two places. The patient's condition was grave throughout the operative procedure, so that no further steps could be considered and the abdomen was quickly closed. The exact character of the mesentery and the mobility of the bowel could not be studied for the same reason. Under medical and thermal stimulation and injections of fluid, the child made a surprisingly rapid postoperative recovery and soon began to take his feedings well. The stools, forty hours after the

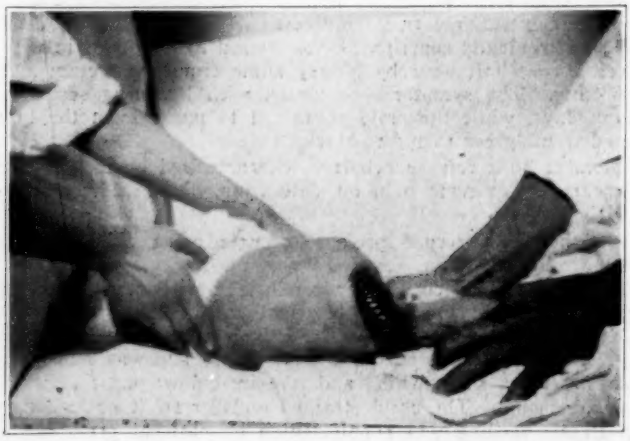

Fig. 1.—Appearance of protruding mass on Oct. 12, 1923.

operation, contained no blood but a great deal of mucus, which gradually increased in amount, and he vomited only once.

On October 18, at 9 a. m., the stool was found again to be blood streaked. A second stool at noon contained bloody mucus, but was well formed. At 12:15, proplase of 2½ inches occurred and was easily reduced. At 2:30 p. m., a recurring prolapse of from 5 to 6 inches (12.7 to 15.24 cm.) was reduced with difficulty. The character of the prolapse was somewhat similar to that found on admission and illustrated in the photograph taken at this time (fig. 2). Its distal tip was black, almost necrotic, and the remainder mahogany-colored. The tip was dry, but the proximal portion was moist and bled freely on manipulation. No discharge could be observed from the lumen of the intussusceptum, but bloody mucus was more or less constantly expelled through the anus. Coincident with the prolapse, a mass, not tender and slightly mobile, could be felt in the left lower quadrant of the abdomen. The condition gradually improved, and the stools became almost normal and free from blood for at least twenty-four hours.

On October 21, at 2 p. m., a similar prolapse, 3 inches in length, occurred and was reduced manually with great difficulty. This came down at 4 p. m., and thereafter remained down most of the time until 7 p. m., when it was reduced by aid of sodium bicarbonate rectal inflation, with much difficulty. The child's hip was elevated, abducted and flexed, and the knees drawn back. One

finger was inserted well past the internal sphincter and the soda enema instilled, the tube passing along the finger. The mass could be felt gradually reducing itself into the intussuscipiens, while the hand palpating the left lower quadrant of the abdomen felt it to be diminishing in size. The finger was kept in the rectum for several minutes, the sphincters being very lax, until the distal end of the intussusceptum could no longer be felt, and the soda enema was expelled with surprising force. However, the mass in the left lower quadrant had not disappeared in the meantime. A few minutes later the finger was reinserted, and the tips of the intussusceptum could no longer be felt. Two hours later it was a question as to whether the mass could be felt in the abdomen, and the next day it was definitely absent on palpation. At this stage, a permanent reduction was apparently effected. In the meantime, the child had passed two soft yellow stools with curds but without any blood. This was the last time the prolapse occurred.

From this time on, emaciation became markedly progressive, and the child underwent alternating periods of improvement and regression. Diarrhea set in toward the end of the month and could not be checked. No blood was present, however. The temperature rose to 103 and 104 F., and remained so for several days until the last forty-eight hours, when it became subnormal. In the meantime the usual efforts of forced feeding, injections of fluid and occasional stimulations were of only momentary avail. Several times, death seemed to be a matter of only a few minutes, but remissions occurred until November 8, when, after about thirty-six hours of fair comfort, the child finally died, without any immediately preceding clinical change.

The previous history was as follows: The patient was a full-term child of the mother's sixth and latest pregnacy; breech delivery, thirty minutes of postnatal artificial revival, weighed 9¾ pounds (4.4 Kg.). The weight at about the time of onset was 14½ pounds (6.4 Kg.).

The father and mother were living and well; their ages were 34 and 33, respectively. Four other children, aged 9, 7, 6 and 4, were living and well. The fifth pregnancy had resulted in a miscarriage, not induced, at three months.

The attending pathologist, Dr. William G. Hibbs, who performed the postmortem examination, makes the following statement:

"Anatomic Diagnosis: Markedly dilated colon; ulcerative and gangrenous colitis; extensive fibrinous adhesions between (1) great omentum, front abdominal wall, loops of small bowel, mesentery, cecum and colon, and (2) loops of small bowel and front abdominal wall; hyperemia of the mesentery and bowel; serosanguineous hydroperitoneum; acute fibrinous perisplenitis; hyperplasia of the spleen, and of the lymphoid tissue of the bowel; acute emaciation; recent almost-healed surgical wound of the abdomen; hyperemia of the brain; edema of the leptomeninges; generalized anemia; hypostatic hyperemia and edema of the lungs; slight hydrothorax (right); multiple fluid-injection needle puncture wounds of the breast (collodion-covered and iodine stained skin); external abrasions; fatty changes of the kidneys; cloudy swelling of the kidneys; multiple petechial hemorrhages into the skin; 'kidney sands'; distended right ureter; mucopurulent right otitis media and mastoditis; phimosis; undescended right testis; retained fetal lobation markings of the kidneys."

The necropsy record pertaining to the abdomen was as follows: "There is an almost-healed recent surgical wound of the left half of the front of the abdomen, which is 7 cm. long; its upper margin 3 cm. above the navel and 2 cm. to the left of it. There are five stitch scars; the lower 1.5 cm. is dry, crusted, dark red, a little depressed for a place 1 cm. in diameter. The skin just above the front left upper spine of the ilium is a little abraided. The skin of the abdomen in front is generally stippled with hundreds of pin-point size petechial hemorrhages. The subcutaneous fat of the trunk in front is almost absent. The loops of the small bowel are adherent generally by rather firm fibrous adhesions and to the almost healed surgical wound of the front abdominal wall. The great omentum generally is adherent around the transverse colon and

attaches many loops of the bowel to the transverse colon by fibrous adhesions. There are about 3 cc. of clear sanguinous fluid in the pelvic cavity. From the splenic flexure downward the descending colon is generally thick-walled, gray, practically empty and generally 1.5 cm. in diameter, which is in marked contrast to the transverse colon, for the contracted descending colon balloons out into a funnel-shape and is then uniformly distended up to the ileocecal valve region where it is 12 cm. in circumference. The great omentum and the fibrous adhesions here are so contracted that the cecum and loops of small bowel are wrapped together. This region presumably is the region of the previously invaginated bowel which was continuous at least to the splenic flexure. The colon is torn easily by the separation of the fibrous adhesions, exposing the fluid content which is granular and dark brown. The mesentery is markedly hyperemic. The lymph nodes of the mesentery of the small bowel are markedly prominent and are 5 cm. in diameter, to confluent masses 15 mm in diameter, the latter being near to the attachment of the mesentery, especially at the ileocecal valve region. The small bowel is generally friable and is most hyperemic in the distal ileum where the mesentery is so firm as to cut with difficulty. The distal 7 cm. of the ileum is adherent to the adjacent cecum by firm fibrous adhesions which can be separated only by the knife. The appendix vermiformis is up and back of the cecum normally. The wall of the cecum is edematous and shaggy where the fibrous adhesions have been torn away from the great omentum. The lining of the rectum is smooth and gray and the wall is only normally thick. The bowel measures 345 cm. from duodenum to cecum, 56 cm. from cecum to rectum. The colon when opened along the mesenteric attachment is very thin-walled, the lining smooth because of the distention. At a place 6 cm. proximal to the sigmoid there is a contracted ulcer 5 mm. in diameter, its base hyperemic, a little depressed and the adjacent lining contracted and wrinkled. The lining of the entire colon is smooth, hemorrhagic in places, but nowhere definitely gangrenous, except perhaps at a place 16 cm. distal to the ileocecal valve where the entire circumference of the lining for a place 5.5 mm. wide is generally pink to brown, but centrally bright red. The lining of the rest of the bowel is unchanged except for hyperemia."

COMMENT

The discussion of our case lends itself to four main headings, namely, (1) the etiology and mechanism of production, (2) diagnosis, (3) the chronicity of the course, and (4) the recurrence of the condition.

1. The etiology of prolapsus intussuscepti is based on the two separate conditions, (*a*) that of intussusception and (*b*) that of prolapse. With an understanding of the known and theoretical causes that might produce intussusception, one might feel that in such a case as ours, prolapse could not have occurred without an abnormally long and free mesentery. However, in our case we were unable to find such a condition present. Therefore, we are forced to conclude that an intussusception may prolapse when the mesentery is of relatively normal length. The actual physiologic mechanism which immediately ushers in the intussusception, that is, an anomaly of peristalsis, is of minor import in our discussion of this case, as it acts more or less similarly in all cases of intussusception regardless of the predisposing cause. With regard to the prolapse itself, the same factors probably entered into its production as occur in prolapsus ani, such as those summarized by Holt and

Howland,[14] namely, the lack of support furnished by the levator ani muscle, the scanty ischiorectal fat, tenesmus accompanying inflammation of the rectal mucous membrane, chronic constipation, phimosis or stricture of the urethra and stone in the bladder. Tenesmus in this case was caused by the bearing-down sensation of the intussusception. Of these factors, only the bladder stone can be wholly eliminated in our instance. This patient had a definite phimosis, which is said to play a part in the production of some cases of intussuception, according to Gibson,[9] and Weiss,[15] in his resumé of etiology, includes Gibson's case in his list.

2. The diagnosis of prolapsus intussuscepti depends on the following facts: On digital examination, the palpating finger may be introduced for varying distances beyond the anus without encountering any abnormality in the rectal wall or lumen, along which the intussusception has passed and protruded through the anus, whereas in true prolapsus ani

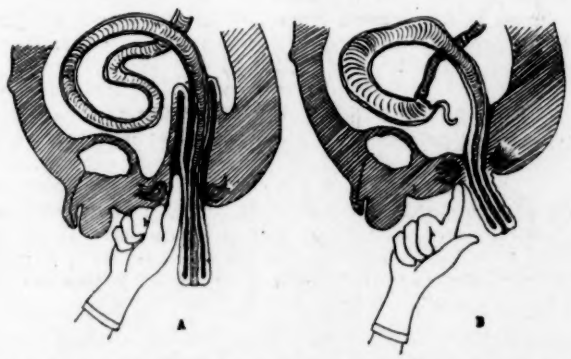

Fig. 2.—*A*, prolapsus intussuscepti; the palpating finger passes up in the groove between the intussuscipient normal rectum and the prolapsed intussusceptum; *B*, prolapsus ani; the palpating finger meets the prolapsed rectum at the anal orifice, the rectal mucous membrane being directly continuous with the epithelium of the anus.

or recti the finger meets the protruded rectal wall at or just within the anus, the mucous membrane of the prolapse being directly continuous with the epithelium of the anus (fig. 2). This, together with palpation of the sausage-like mass usually in the left lower quadrant of the abdomen, constitutes the pathognomonic sign of prolapsus intussuscepti.

3. It must be admitted that our case is one of chronic intussusception with more or less subacute recurrences. This onset was essentially the same as that of an acute case, except in degree, and was ushered in with the characteristic symptoms of severe pain with doubling up, vomit-

14. Holt, L. E., and Howland, J.: The Diseases of Infancy and Childhood, ed. 9, 1926, p. 336.

15. Weiss, S.: Intussusceptio intestini, Zentralbl. f. Grenzgeb. d. Med. u. Chir. **2**:702, 1899.

ing and stools, which resembled currant jelly, and the usual signs of acute intoxication or shock. These initial symptoms recurred with each attack but became gradually and progressively less marked. During a severe attack, the child was admitted and operated on. After the operation, the intestinal tract was apparently never completely obstructed, and was perhaps normaly open at times, as relatively normal stools or stools only occasionally and slightly streaked with blood were passed for many days. According to Still,[16] "The entire absence of blood from stools throughout or the slight and transitory character of the bleeding when present are features of chronic intussusception." Vomiting was seldom present after the operation, a point noted by Keen,[1] who said, "In the chronic variety, vomiting may be absent altogether or not at all constant." In contrast with the acute cases, in which the patients usually die well nourished, progressive wasting is a characteristic picture in chronic cases. In our cases, the weakness and emaciation, which were part of the picture during an exacerbation, had a deterring effect on the recovery of the strength during a remission, so that a vicious cycle was always in play. Porter and Carter[17] say: "The (usual) findings together with lack of fever, progressive wasting and recurrent periods of temporary bowel obstruction, constitute the characteristic picture" of chronic intussusception.

4. During the so-called periods of remission, spontaneous reduction must have occurred, because characteristic symptoms were absent, rectal examination was negative and no mass could be palpated in the abdomen. Moreover, proof of such a reduction was found at the postmortem table. At such periods, the child took its feedings comparatively well, did not vomit, and had relatively normal bowel movements. Relapses were characterized by vomiting, accentuated emaciation and at times by recurring prolapse. Bimanual examination at these times showed the prolapse to be like a cervix uteri in the rectum, and the mass could be felt attached to this in the left lower quadrant of the abdomen. When the prolapse recurred and reduction seemed somewhat difficult, we injected varying amounts of warm sodium bicarbonate solution in a manner similar to the classic inflation method. This may have been a factor in the reduction of the recurring intussusception, a belief probably held by Gerrod, Batten and Thursfield,[3] who state that "cases with long mesenteries can be reduced by distention because the mesentery can be stretched." As long as the child's strength permitted him to strain forcibly enough, prolapse was liable to occur. Operations that relieve intussusception often unavoidably fail to remove the cause and succeed

16. Still, G. F.: Chronic Intussusception in Children, Arch. Pediat. **38**:174, 1921.

17. Porter, L., and Carter, W. E.: Management of the Sick Infant, 1922, p. 218.

only in remedying the effect, as causes cannot often be found at this time, and postoperative recurrences are therefore not uncommon. Cohen [18] brings forth evidence to this effect in his report of four cases and a review of the literature on the subject.

SUMMARY

1. An unusual case of chronic intussusception with prolapse (prolapsus intussuscepti) is reported with clinical and postmortem observations, and the condition defined.

2. A review of the medical literature reveals that such cases are frequently mentioned in the textbook, but we have encountered only seven case reports, most of which are inadequately described, and two of these were in adults.

3. Prolapsus intussuscepti usually occurs when the mesentery is abnormally long and free, and the usual factors in production of prolapsus take part.

4. The sign that differentiates this from a simple prolapse lies in the fact that the palpating finger can be passed well up between the intussuscipient normal rectum and the prolapsed intussusceptum, at the same time that the sausage-like tumor can be felt in the left lower quadrant of the abdomen.

5. The chronicity and recurrence of the condition are explained by varying degrees or absence of intestinal obstruction. Prolapse occurred only as long as the child was able to strain forcibly in his attempt to overcome the more or less complete, temporary obstruction of the bowel. After emaciation became pronounced, prolapse no longer occurred.

18. Cohen, M.: Postoperative Recurrence of Intussusception, Am. J. Dis Child. **21**:410 (April) 1921.

Progress in Pediatrics

DIPHTHERIA IN INFANCY*

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Diphtheria in the first year of life is rare, according to most authorities. Rolleston [1] and Deacon [2] found an incidence of 0.7 per cent in 2,600 and 31,000 infants, respectively; Baginsky [3] reported an incidence of 0.15 per cent in 2,700 infants under 6 months of age. However, McCollum and Place [4] give the incidence as 2.75 per cent. This rarity is variously attributed to (1) inherited immunity through placental transmission of antitoxin; (2) lack of exposure; (3) acid secretions in the infant's mouth, and (4) antitoxin transmitted through the mother's milk. Most textbooks merely make general statements concerning the relative immunity that is present in infants under 6 months of age.[5] On the other hand, Ribadeau-Dumas, Lacomme and Loiseau [6] claim that diphtheria in the new-born is uncommon only because it is often overlooked.

In 2,400 consecutive admissions for diphtheria on the contagious service of the Cincinnati General Hospital, there were forty-nine infants under 1 year of age—an incidence of 2.04 per cent. Fourteen of these forty-nine died, a mortality of 28.5 per cent, as contrasted with an average mortality at all ages of 8 per cent. The laryngeal type was particularly fatal, eleven out of seventeen infants dying. However, Deacon [2] reports a mortality of 62 per cent in laryngeal diphtheria in infants under 1 year.

ETIOLOGY

Race.—There were forty-six white and three negro infants. This disproportion is interesting, because it is known that negroes are less susceptible to diphtheria than are whites.[7]

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* From the Contagious Service, Department of Pediatrics, University of Cincinnati.

1. Rolleston, J. D.: Diphtheria, Am. J. Dis. Child. **12**:47 (July) 1916.
2. Deacon, W. J. V.: Am. J. Pub. Health **14**:404 (March) 1924.
3. Baginsky: Nothnagel's Handb. d. Spec. Path. u. Therap. Diphtheria.
4. McCollum, J. H., and Place, E. H., in Osler's Modern Medicine, ed. 2, Vol. 1, p. 690.
5. Abt: Pediatrics, vol. 6, 1926, pp. 70, 82. Holt and Howland: Diseases of Infancy and Childhood, ed. 8, 1922, p. 983. Griffith, J. C.: The Diseases of Infants and Children, ed. 1, 1920, vol. 1, p. 443. Kerley: Practice of Pediatrics, ed. 3, 1909, p. 687.
6. Ribadeau-Dumas; Lacomme, L., and Loiseau: Bull. et mém. Soc. méd. d. hôp. de Paris **48**:1326 (July 25) 1924.
7. Hoyne, A. L.: Arch. Pediat. **35**:513 (Sept.) 1918. Crum, F. S.: Amer. J. Pub. Health **12**:5 (May) 1917.

Sex.—Twenty-one of the infants were boys and twenty-eight were girls. These figures are not so striking as are those of Günther,[8] who states that many more girls than boys have diphtheria in the first year.

Environment.—Nineteen of these infants were from families living in private homes; thirty were from crowded tenements or institutions in which opportunity for exposure might be greater.

Breast Feeding.—Some authors have advanced the opinion that the infant's immunity is the result of antitoxin transmitted in breast milk, although more recent work has seemed to show that in man the immunity is conferred through placental transmission.[9] It is interesting that almost half of these infants were entirely breast fed from birth and that a third of the remainder were partially breast fed. Ruh and McClelland[10] found negative Shick reactions in 8 per cent of infants who had never received any breast milk.

Exposure.—There was known exposure to diphtheria in only 20 per cent of the cases. In most instances, this exposure was intimate and prolonged.

*Data of Infants Having Diphtheria in Cincinnati General Hospital**

Age	Cases	Age	Cases
7 days	2	5 months	1
16 days	1	6 months	8
17 days	1	7 months	2
30 days	1	8 months	3
2 months	1	9 months	8
3 months	2	10 months	7
4 months	1	11 months	11

* All of the children under 2 months of age had the nasal form.

Syphilis.—Rolleston[1] states that congenital syphilis is an important predisposing cause of diphtheria in the first year. In this series, only two of the forty-nine infants had clinical or serologic evidence of syphilis.

Types.—Forty-two per cent had a pure nasal diphtheria; 64 per cent, the nasal form alone or combined with other types. Primary nasal diphtheria occurred in the series in only 18 per cent of the infants over 1 year of age. These figures are in contrast with the statement of some authors. Abt[5] says, "Nasal diphtheria by itself is not very common, but is more frequently seen as an extension from the severe and septic forms." However, Hermann[11] states that diphtheria is more likely to be restricted to the nose in young infants than in older children.

8. Günther, H.: Zentralbl. f. inn. Med. **45**:290 (April 19) 1924.
9. Kuttner, G. F., and Ratner, B.: Importance of Colostrum in New-Born Infant, Am. J. Dis. Child. **25**:413 (June) 1923.
10. Ruh, H. O., and McClelland, J. E.: Comparison of Diphtheria Immunity in Mother and in New-Born, Am. J. Dis. Child. **25**:59 (Jan.) 1923.
11. Hermann, E.: Jahrb. f. Kinderh. **93**:273, 1920.

The most common symptom was a sanguineous mucopurulent nasal discharge, rarely profuse but usually persistent. A mild degree of fever, gastro-intestinal disturbance and restlessness were noted only occasionally. This is not the experience of Ribadeau-Dumas, Lacomme and Loiseau,[6] who find digestive disturbance, fever and coryza as the classic manifestations of diphtheritic infection in the very young.

A nasal membrane was noted in only four instances. The course in the cases of a purely nasal form was uniformly mild, and the infection responded almost immediately to antitoxin. The one death in twenty cases was due to a secondary empyema.

In the cases in which the pharynx alone was involved, the usual symptoms were fever, restlessness and anorexia. Membrane was uniformly present on one or both tonsils. In three patients, there was a follicular distribution over both tonsils, bringing to mind Ker's [12] statement that in the absence of scarlet fever, follicular tonsillitis in children under 2 years of age is usually diphtheritic in origin.

A moderate cervical adenitis was present in every case but extensive enlargement of the cervical nodes occurred only once. Most of the infants with pharyngeal diphtheria were sicker than those with nasal infection, but in only three instances could the disease be classed as severe. The two deaths occurred in patients who had extensive formation of membrane and who were treated late; in both cases, death was attributed to myocardial failure.

The deadly potentialities of diphtheria in infancy are best exemplified by the laryngeal form in which the melancholy results contrast strikingly with the benign course and happy outcome in the purely nasal cases. Of seventeen infants with the former type, only six survived—a mortality of about 65 per cent. The presence of a sanguineous rhinitis in six of these patients several days before the onset of respiratory symptoms emphasizes the necessity for careful observation of any infant with a persistent nasal discharge, especially when it is bloody.

The earliest symptoms and physical signs of the laryngeal type were rhinitis, snuffles, cold, cough and "wheezing"; the most constant symptoms were pallor, hoarseness, dyspnea, inspiratory and expiratory stridor and retraction of the soft parts of the chest; cyanosis, fever and cervical adenitis were less frequent symptoms.

The average duration of symptoms before treatment in the cases of laryngeal infection was three and one-half days, with an extreme of six days in two instances. Membrane was noted in the pharynx in four cases. The three infants who did not require intubation survived, the duration of symptoms prior to treatment being less than two days in each case. Intubation was performed on fourteen patients, four of

12. Ker, C. B.: Infectious Diseases.

whom recovered. There were six secondary tracheotomies, and only one patient survived the immediate effects of the operation. This is in accord with the views of Klotz,[13] who states that he has never noted recovery in any infant under 1 year of age on whom tracheotomy has been performed.

In one fatal case there was membrane extending throughout the mouth, pharynx, esophagus and into the stomach. Severe vomiting was an early symptom in this patient, and the temperature was high. In one infant there was a diphtheritic ophthalmia associated with nasal infection. Membrane was present in both eyes, and corneal ulcers developed bilaterally. Antitoxin given intramuscularly and locally with hot compresses effected a complete cure without scarring of the cornea.

Diphtheritic infection of the skin [1] and vagina is said to be far from rare in infants, but no instance of either was noted.

COMPLICATIONS

Otitis media occurred in 17 per cent of this series, and in one instance was associated with generalized convulsions which were promptly relieved by myringotomy.

Bronchopneumonia was noted in 14 per cent, was associated with the laryngeal type in two thirds of the cases, and was the probable cause of four deaths.

Myocardial failure occurred in 6 per cent of the cases. In every instance the patient was treated late. It was characterized by vomiting; pallor; prostration; rapid, weak pulse, and quick death.

Serum sickness manifested itself by a slight transient rash and a mild degree of fever in only 8 per cent.

Paralyses, which have an incidence of from 10 to 20 per cent in diphtheria,[14] were not noted in this series. Perhaps the early death in the severe cases and the mildness of the infection in the infants surviving may account for their absence, although in regard to the latter factor it should be said that in early life paralysis is common in mild cases.

There was no instance of persistence of diphtheria organisms in this series, possibly because of the relative lack of adenoid and tonsillar lymphoid tissue in children of such tender years. This is unusual, according to Rominger,[15] who found antitoxin of little value in treating either patients with clinical diphtheria or carriers among the new-born. The white blood cell count varied from 9,000 to 40,000, with an average of 20,000, the lymphocytes usually being around 50 per cent.

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13. Klotz, M.: Deutsche med. Wchnschr. **50**:1576 (Nov. 14) 1924.
14. Footnote 5 (second reference).
15. Rominger, E.: Ztschr. f. Kinderh., vol. 26, Sept. 13, 1926. Leitz, F. H.: Monatschr. f. Geburtsh. u. Gynak., vol. 52, November, 1920.

In striking contrast to the frequent presence of albuminuria in older patients having diphtheria, the urine of these infants was uniformly normal, with one exception; this patient died from bronchopneumonia and acute nephritis on the fifth day after admission.

The dosage of antitoxin varied from 2,000 to 65,000 units, depending on the severity of the case. The average dose was 10,000 units and was usually given intramuscularly. In some of the severe cases part of the dose was given intravenously and part intramuscularly.

COMMENT

Forty-nine cases of diphtheria in infants less than 1 year of age are reported.

This series of cases of clinical diphtheria is in accordance with the Shick test in showing that many young infants do not possess immunity to diphtheria.

Congenital syphilis is not a factor in the etiology.

Young infants are prone to nasal infection; in them, the only constant symptom is a sanguineous rhinitis. The fact that nasal infection not infrequently precedes laryngeal involvement emphasizes the necessity for early diagnosis and treatment.

Abstracts from Current Literature

Anatomy and Physiology

RESEARCHES ON THE PHYSIOLOGY OF THE WHITE CELLS. CYTODIAGNOSIS AND ITS CLINICAL APPLICATION. A. ALEXEIEFF, Centralbl. f. Bakteriol. **101**:240, 1926.

This paper, illustrated with plates and figures, deals with the morphology and function of the various white corpuscles. The plasma cells are considered to have as their principal function the absorption of poisonous substances: first, because of the basophilic tendency of the cytoplasm, and second, because of the evidences of degeneration as shown by the peripheral pyknosis of the nucleus and the hyaline bodies of Russel in the cytoplasm, these giving evidence of a cell profoundly intoxicated. The author points out, however, that a small proportion are phagocytic and he calls these plasmophages.

The monophages, however, have the power of phagocytosis to a marked degree of erythrocytes, other white corpuscles, bacteria, etc.

The lymphocytes are claimed to produce a lipase, but mainly are conceived to be "toxinophagic," electively absorbing toxic substances. The neutrophilic leukocytes, besides their phagocytic function, have mainly the ability to elaborate proteolytic enzymes and to produce glycolytic enzymes for the general reaction of glycogenolysis.

The author then discusses the theory of "second degree digestion," which maintains that in general digestion and assimilation the white cells play an important rôle, not only in carbohydrate, but also in nitrogenous and fat metabolism. Furthermore, phagocytosis and the entire problem of immunity is only a particular case of this doctrine of "second degree digestion." The great importance of the mesenchymal tissues as a whole is particularly stressed, emphasizing the functional properties of phagocytosis, detoxication and ferment action possessed by the various cells of this tissue which Alexeieff calls, in general, the phagonephro-endocrinocytes.

PAUL R. CANNON.

Pathology, Bacteriology and Biochemistry

THE RELATIONSHIP OF OBESITY TO CARBOHYDRATE METABOLISM. HENRY J. JOHN, Am. J. M. Sc. **173**:184, 1927.

Reports of twelve cases of obesity, three in men and nine in women, are presented, in each of which the carbohydrate metabolism was studied by means of a dextrose tolerance test. The overweight in these cases ranged from 29 to 115 per cent. Glycosuria was present in two cases in both of which diabetes was present. The fasting blood sugar was normal in eleven cases, among which four were cases of diabetes of varying degrees of severity. Among the twelve cases of obesity, two were definitely cases of diabetes; three were cases of mild diabetes or "prediabetics."

AUTHOR'S SUMMARY.

A QUANTITATIVE STUDY OF THE HYPOTHESIS OF THE HUMAN ANENCEPHALITIC FETUS. W. P. COVELL, Am. J. Path. **3**:17, 1927.

This article is based on the study of thirty-two anencephalitic fetuses. An hypophysis, variable in weight, mostly without pars nervosa, with variable pars intermedia, was found to be present.

[ARCH. PATH.]

THE CAUSE OF THE DELAYED CLOTTING OF HEMOPHILIC BLOOD. W. H. HOWELL and E. B. CEKADA, Am. J. Physiol. **78**:500, 1926.

In a study of three hemophilic patients, brothers, it was found that the prothrombin content of the blood did not vary from normal either quantitatively or qualitatively. The blood platelets, on the other hand, were much more resistant than those of normal blood, and the authors account for the hemophilia by their slow disintegration.

THE ABSORPTION OF BILE PIGMENT FROM THE INTESTINE. J. L. BOLLMAN, C. SHEPARD and F. C. MANN, Am. J. Physiol. **78**:658, 1926.

On determining the content of bilirubin in the mesenteric veins and in the arterial circulation of dogs, using the spectophotometric method, which was sufficiently sensitive to detect any addition of bilirubin in known sites of its formation, essential differences were not found in the two values. This was true regardless of whether the animals were fed more or less recently, or were fasting, or even after the introduction of large amounts of bile into the intestine. Parallel determinations of rose bengal showed much absorption from the intestine. Further, introduction of large amounts of bile into animals after common duct ligation and gallbladder extirpation, did not have any effect on the rate of developing jaundice. The authors state definitely that there is not any intestinal absorption of bilirubin under their experimental conditions.

CRETINISM AND MYXEDEMA PRODUCED EXPERIMENTALLY IN SWINE. H. D. CAYLOR and C. F. SCHLOTTHAUER, Am. J. Physiol. **79**:141, 1926.

Because of peculiarities in anatomy and physiology, swine were found satisfactory animals for the production of experimental myxedema and cretinism. They responded quickly to thyroid deficiency with definite symptoms. Distinct parathyroids were not found, islands of parathyroid tissue being located in accessory thyroids. Tetany did not develop in animals completely thyroidectomized. A more marked reaction developed in animals operated on before puberty. There was an apparent hypersusceptibility to disease in thyroidectomized animals.

H. E. EGGERS.

EXPERIMENTAL EPIDEMIOLOGY OF TUBERCULOSIS. DAVID PERLA, J. Exper. Med. **45**:209, 1927.

Normal guinea-pigs exposed to tuberculous cage mates infected intraperitoneally and without cutaneous ulceration readily contract spontaneous tuberculosis. The incidence of spontaneous tuberculosis increases with the intensity and with the duration of exposure. Spontaneous tuberculosis acquired from infected cage mates has with few exceptions the characters of an infection that has entered by way of the digestive tract, disease of mesenteric and cervical lymph nodes being conspicuous. Guinea-pigs exposed to tuberculous animals in the same room but not in the same cage may acquire tuberculosis that has the character of a bronchiogenic infection associated with lesions of the lungs and tracheobronchial lymph nodes.

AUTHOR'S SUMMARY.

THE RELATION BETWEEN INVASION OF THE DIGESTIVE TRACT BY PARATYPHOID BACILLI AND DISEASE. THEOBALD SMITH and HELENA A. M. TIBBETTS, J. Exper. Med. **45**:337, 1927.

Hog cholera bacilli fed to mice disappear from the stomach within twenty-four hours, but remain and perhaps multiply in the ileum for at least several

weeks. They promptly penetrate the mucosa and may be found in the spleen. Bacilli introduced subcutaneously quickly pass into the intestinal tract where they may be found for some weeks. Infected mice may harbor bacilli in the spleen for several months. Mice possess a relatively high degree of natural resistance toward hog cholera bacilli which gives way to large doses. Disease is probably the result of the invasion of the viscera from the digestive tract following feeding, but the relation between the dose fed and the numbers penetrating the mucosa is variable and the conditions favoring such invasion are not determined. Contact with mice discharging bacilli failed to cause recognizable invasion of the digestive tract or the viscera.

AUTHORS' SUMMARY.

FURTHER OBSERVATIONS ON THE TOXINS OF HEMOLYTIC STREPTOCOCCI. MARY B. KIRKBRIDE and MARY W. WHEELER, J. Immunol. **13**:19, 1927.

Although as a result of further studies it may be possible to distinguish a specific group of scarlet fever streptococci, up to the present, in toxin neutralization tests with a serum produced with the Dochez scarlet fever strain, fundamental differences have not been found in the strains isolated from typical cases of scarlet fever and in those isolated from many other infections.

[ARCH. PATH.]

RELATION OF ANAPHYLAXIS TO IMMUNITY. W. H. MANWARING, P. W. SHUMAKER, P. W. WRIGHT, D. L. REEVES and H. B. MOY, J. Immunol. **13**:59 and 612, 1927.

The blood of an actively immunized dog does not contain any antibody that serves as a demonstrable circulating defense to hypersensitize fixed tissues. The immune blood, however, does contain a desensitizing substance, capable of causing complete desensitization of hypersensitive fixed tissues. This desensitization is effected only after a latent period of about forty-eight hours. All phenomena of passive desensitization or passive immunization thus far studied in dogs may be accounted for as a result of the action of this desensitizing antibody. As pointed out in previous papers, there is conclusive evidence that in dogs the sensitizing antibody and desensitizing antibody are of different chemical composition, and that neither of these substances is identical with the specific precipitin of the test tube reactions.

Tissues of actively immunized dogs transplanted by blood vessel anastomosis into hypersensitive recipients show a complete acquired insusceptibility to the hepatic anaphylatoxin. The hepatic anaphylatoxin, therefore, must be regarded as a secondary antigen, presumably of protein nature, and conceivably a denaturization product of the primary antigen. The anti-anaphylatoxic immunity factor is apparently not transferred from one animal to another by even massive immune blood transfusion.

[ARCH. PATH.]

CULTIVATION OF VIRULENT BACTERIA FROM ENCEPHALITIC VIRUS. ALICE C. EVANS, Pub. Health Rep. **42**:171, 1927.

Six strains of so-called virus were studied bacteriologically. Four of the strains were originally from vesicles in cases of herpes, one was from the cerebrospinal fluid in a case of syphilis and one was from the brain in a case of epidemic encephalitis. Cultures of virulent streptococci, and cultures of a spore producing rod were obtained from all six strains.

AUTHOR'S SUMMARY.

ULTRAMICROSCOPIC VIRUSES: I. CELL INCLUSIONS ASSOCIATED WITH CERTAIN ULTRAMICROSCOPIC DISEASES. G. M. FINDLAY and R. J. LUDFORD, Brit. J. Exper. Path. **7**:223, 1926.

A review is given in pictographic form of the voluminous literature on the intracellular inclusions associated with twenty-two diseases due to ultramicroscopic viruses: variola and vaccinia, sheep-pox, fowl-pox, scarlet fever, molluscum contagiosum, trachoma, rabies, distemper, varicella, herpes, meningoencephalomyelitis of horses, virus III infection of rabbits, paravaccinia, infections of unknown etiology, virus from guinea-pigs, foot and mouth disease, warts, polyhedral and other ultravirus diseases of insects, fowl plague, swine fever, African horse sickness and a disease of fowls.

[ARCH. PATH.]

EFFECT OF VARIATIONS OF SALT CONTENT OF BLOOD ON THE BACTERICIDAL POWER. A. FLEMING, Brit. J. Exper. Path. **7**:274, 1926.

Leukocytes function efficiently only within certain limits of salt concentration, and when the salt content falls below or rises above these limits, the leukocytes do not emigrate and do not take up or destroy bacteria. When a large amount of salt is injected into an animal, so that the salt content of the blood is materially raised, the normal bactericidal power is temporarily lost, but after a few hours it is greatly enhanced. When smaller doses are injected, the preliminary fall in the bactericidal power is avoided, but the subsequent rise is marked, and in man, the injection of an amount of salt so little that when diluted with the blood it would increase the salt content by only 0.01 per cent causes after three hours a great rise in the bactericidal power of the blood. The intravenous injection of hypertonic salt solution has been used in cholera and other diseases, with a view to increasing the blood volume, but the results detailed by Fleming show that such injections may produce benefit, not only by virtue of their fluid content, but also by conferring on the patient's blood greater powers of destroying the infecting bacteria.

[ARCH. PATH.]

THE RÔLE OF THE RETICULO-ENDOTHELIAL SYSTEM IN THE REGULATION OF THE NUMBER OF PLATELETS IN THE CIRCULATION. S. P. BEDSON, Brit. J. Exper. Path. **7**:317, 1926.

The temporary upset in function of the reticulo-endothelial cells produced by filling them with carbon particles, Bedson avers, is associated with a considerable increase in the number of platelets in the circulation. Removal of the spleen when blockade of the reticulo-endothelial system is at its height of functional activity is not productive of any further rise in the platelet count. The spleen would appear to regulate the number of platelets in the circulation by means of its reticulo-endothelial cells. In view of the essentially phagocytic nature of these cells, it seems reasonable to suppose that they take up and destroy the platelets which are not any longer of use. When the spleen is removed, this function is taken on by some other portion of the reticulo-endothelial system.

AUTHOR'S SUMMARY.

METHOD FOR DETERMINING THE ANTISCORBUTIC VALUE OF A FOODSTUFF BY MEANS OF HISTOLOGICAL EXAMINATION OF THE TEETH OF YOUNG GUINEA-PIGS. AXEL HÖJER, Brit. J. Exper. Path. **7**:356, 1927.

In the absence of scurvy cross-sections of the incisor root show in hematoxylin-eosin sections a broad, uniformly stained pink layer of dentine, a white,

uncalcified predentine, a layer of slender parallel odontoblasts and a pulp of small, star-shaped cells. When deficient or no antiscorbutic is furnished in the diet, the picture becomes different: The dentine is not stained uniformly and is rather thin; the predentine stains deeply with hematoxylin because it is calcified, and the odontoblasts are changed in shape and arrangement.

[ARCH. PATH.]

STUDIES IN CALCIUM AND PHOSPHORUS METABOLISM. PART 4. THE INFLUENCE OF FREE FATTY ACIDS IN THE INTESTINE ON THE ABSORPTION AND EXCRETION OF THE MINERAL ELEMENTS. S. V. TELFER, Quart. J. Med. **20**:1, 1926.

In a case of catarrhal jaundice fat absorption was reduced by 20 per cent during the period that bile was excluded from the intestines. There was then an increase in fatty derivatives and calcium soaps. The absorption of phosphoric acid was increased as shown by the high phosphoric content in the urine. This was due to the combination of calcium with soaps reducing the amount of calcium phosphate. When the condition was improving, the phosphate of lime increased and as this increased the calcium excreted decreased, showing that linkage of calcium with fatty acids prevented the absorption of the phosphate of lime. In a previous article the author had shown that conditions which permit the excretion of free fatty acids in the intestine facilitate the absorption of phosphorus.

STUDIES IN CALCIUM AND PHOSPHORUS METABOLISM. PART 5. INFANTILE RICKETS. THE EXCRETION AND ABSORPTION OF THE MINERAL ELEMENTS AND THE INFLUENCE OF FATS IN THE DIET ON MINERAL ABSORPTION. S. V. TELFER, Quart. J. Med. **20**:7, 1926.

During the active stages of the disease, the lime, magnesium and phosphoric content of the feces is high, because of defective absorption due to some change in the intestines. This is reduced when healing takes place. The phosphorus is first absorbed in excess, the urine containing a high percentage. Cod liver oil has a specific effect in increasing the absorption of the minerals by altering those conditions in the gastro-intestinal tract which prevented their free absorption.

THE ACTION OF INSULIN IN GLYCOGEN FORMATION AND ITS THERAPEUTIC APPLICATION. R. D. LAWRENCE, Quart. J. Med. **20**:69, 1926.

Exercise increases the hyperglycemic action of insulin, and the combined effect of insulin and exercise is greater in burning carbohydrate than that of exercise alone. Considerable discussion is offered on the metabolism of carbohydrate and fat and the formation of glycogen and on the specific action of insulin. The author considers that insulin does not really burn carbohydrate but changes it into glycogen and that its main function is to provide for glycogen storage. In diabetes, the increased tolerance to insulin is probably due to the increased storage of glycogen. The hypoglycemic action of insulin is, therefore, much more marked when glycogen storage is decreased. The studies were made on a diabetic patient who was well trained and who understood the principles of diet and exercise. Hypoglycemia was constantly produced by violent exercise plus the patient's regular dosage of insulin.

N. ENZER.

VIRULENT FILTRABLE ELEMENTS OF THE TUBERCLE BACILLUS. A. CALMETTE and J. VALTIS, Ann. de méd. **19**:553, 1926.

Fontes, of the Oswaldo Cruz Institute at Rio de Janeiro, by investigating, in 1910, the so-called Much granules found in tuberculous material, noted the

presence of virulent filtrable elements in the pus from a tuberculous abscess. The discovery of Fontes remained unnoticed until 1922, when Vaudremer found similar elements in cultures of tubercle bacilli.

Experiments in the same direction, made in Calmette's laboratory, have confirmed the fact that filtrates from tuberculous sputum or pus contain invisible elements which are virulent, leading to a typical tuberculosis. It was also noted that acid-fast bacilli are found in the lymph nodes of rabbits twelve days after an intraperitoneal injection of such a filtrate. By intravenous injection of the filtrate tubercle bacilli can be found shortly after the injection, in the rabbit's spleen.

The form under which these elements pass through the pores of Chamberland filters is unknown. Fontes' idea that the so-called "Much granules" represent the invisible elements cannot as yet be confirmed.

The "invisible filtrate virus" found in tuberculous material raises anew the problem of congenital tuberculosis. Is it possible that the "filtrable virus" passes through the barrier of the placenta leading in instances to an intrauterine infection with tuberculosis?

B. M. Fried.

Experimental Research of the Virus of Herpes. M. Le Fèvre de Arric, Arch. internat. d. med. exper. **2**:835, 1926.

The author isolated a virus from a case of herpes which involved chiefly the lips, and inoculated it into rabbits. The inoculation was made usually by the subarachnoid route, but he also used epidermal, intracutaneous, subcutaneous, corneal and intratesticular inoculations. The rabbits developed the syndrome of encephalitis characterized by violent convulsions which dominated the picture and to which previous authors had drawn attention, and in addition to this, characteristic symptom complexes of the digestive, respiratory, circulatory and genito-urinary systems occurred. In the case of inoculation into the cornea there was occasional preliminary fever before the onset of symptoms. The blood showed marked leukocytosis with lymphocytopenia and secondary mononucleosis. The urine constantly contained albumin, occasionally casts and phosphates. The cell count of the spinal fluid was high, and four fifths of the cells were lymphocytes. Of the rabbits in which injections were performed by the subarachnoid route about 80 per cent developed the disease within three days, whereas the average duration of time before the onset of symptoms in inoculation of the cornea was from seven to eight days, of the testicle from nine to eleven days, and of the skin from fifteen to twenty days. There were two types of histologic lesions. One was an inflammatory type in which there was intense hyperemia of the meninges with interstitial hemorrhages. This was associated with an irregularly distributed meningeal exudate consisting chiefly of lymphocytes. Marked perivascular infiltration also occurred. In the other type there was rapid degeneration of the neuron, with karyolysis and marked neuronophagia. These lesions were the same as those described in encephalitis, but they were much more acute. They occurred throughout the brain, but to a much less extent in the medulla and cord. Similar lesions were found in the ganglia of the vagus and in the superior cervical sympathetic ganglion. Cellular inclusions, the origin of which was obscure, were found in the ganglion cells. Curiously enough, injection in the subcutaneous tissue gave negative results. It was difficult to isolate a virus in cases of human encephalitis, and in six cases of encephalitis and ten of a pseudoparkinsonian postencephalitic syndrome, the author was unable to obtain an encephalitic

virus. He was also unable to recover the virus of Levaditi or his own herpes virus from inoculations of the fluid or material from human encephalitic cases. He concludes that the virus of herpes presents all the biologic characteristics of the virus said to cause encephalitis. Certain of the viruses of herpes are clearly possessed of an affinity for the central nervous system of the rabbit and in that respect are encephalitic. It is difficult to obtain a virus from a case of human encephalitis which will produce encephalitis in a rabbit.

N. ENZER.

INFLUENCE OF COLD ON THE VIRULENCE OF SOME PATHOGENIC AGENTS. M. CARPANO, Ann. d'ig. **36**:787 (Nov.) 1926.

The gravity of some of the infectious diseases appears to increase during the winter months as compared to the summer. This is probably due to the lowered resistance of the animal as a consequence of the lowered temperature. In these cases a marked morphologic and biologic modification in the infecting agent has been noted, and above all, an increase in virulence. On this basis the author was able to raise the virulence of certain organisms at will by the indirect use of cold, by chilling the animals used for experimental inoculation.

FILTRABLE VIRUS OF TUBERCULOSIS. V. MARINO and F. RICCARDI, Ann. d'ig. **37**:86 (Feb.) 1927.

As a result of their experiments and investigations, the authors hold that in the material obtained from experimentally infected animals, a filtrable form of the tubercle bacillus does not exist.

THE KOTTMANN REACTION IN PEDIATRICS. E. FANTON, Clin. pediat. **9**:301 (March) 1927.

The Kottmann test was performed in five groups of children. The following results were obtained: Group 1 was comprised of seventeen cases of hyperthyroidism and myxedema. In twelve, the reaction was accelerated; in three, delayed and in two, normal. Group 2 was comprised of twenty-three cases of idiocy. The reaction was accelerated in three, delayed in five and normal in fifteen. Group 3 was made up of eighty-nine patients who had a variety of diseases. The reaction was accelerated in twenty-five, moderately accelerated in forty-seven and delayed in seventeen. The diseases giving an accelerated response were: metapneumonic empyema, pulmonary tuberculosis, influenzal bronchitis, bronchopneumonia, bronchiectasis, lobar pneumonia, cardiac lesions, dyspepsia, enteritis, appendicitis, scrofula, tracheobronchial adenopathy, chorea, tuberculous meningitis and influenzal meningitis. Group 4 was made up of twenty-six normal children. All gave normal reactions with the exception of one with a probable hypofunction of the thyroid. Group 5 was comprised of twenty-eight patients who had diseases of the central nervous system. The reaction was carried out on the spinal fluid. An accelerated response was obtained in eight cases of tuberculous meningitis, one of influenzal meningitis, one of meningismus, three of congenital hydrocephalus, one of postencephalitis and four of idiocy.

The author believes that there is a direct connection between the altered function of the thyroid and the Kottmann reaction. Although the reaction is not specific, it is a valuable aid in diagnosing suspected thyroid dysfunction.

ZAMBARANO, Northville, Mich.

CONTRIBUTION TO THE STUDY OF THE MECHANISM OF THE ACTION OF VACCINE THERAPY: THE RED CELL SEDIMENTATION TEST IN VACCINE SHOCK. M. GIUFFRÉ and G. SCONZO, Pediatria **35**:127, 1927.

Giuffré and Sconzo first studied the sedimentation test in cases of typhoid, paratyphoid and Malta fever. They noted here an increase in the rate of sedimentation, which, however, has in their opinion no diagnostic or prognostic importance.

They next studied the test in patients vaccinated against typhoid by the intravenous route. Here they found no alteration in the rate of sedimentation either during or after the reaction to the vaccine.

In cases of typhoid, paratyphoid and Malta fever, intravenous injections of specific vaccine brought about noticeable changes in the sedimentation rate of erythrocytes, viz., in those cases in which desensitization is obtained with only one injection, there is an increase in the rate of sedimentation during the reaction and a decrease at the end of the reaction; the reverse was noted in those cases in which two or more injections were necessary.

The vaccines used were prepared according to the method of Di Cristina and Caronia. The amount used at each intravenous injection was 0.3 cc. The sedimentation test was performed according to the method of Linzenmeier and was determined in each case before the administration of vaccine and at the height and the end of the subsequent reaction.

SALA, New York.

THE LYMPHATIC ORGANS. L. ASCHOFF, Beihefte z. med. Klin. **22**, 1926.

After discussing the general structure of lymphatic tissue, Aschoff states that the functions of the germinative centers in lymph nodes are production of lymphocytes and neutralization of toxic substances. The regeneration of lymphoblasts takes place probably either from old ones or from reticulum cells. The lymphocytes do not possess phagocytic or lipolytic power or special affinity for substances as proteins or carbohydrates. Their function is probably a fermentative one, because they are found in the blood and the chyle and are increased after digestion. The tonsils are not regarded as organs for special protective purposes or as receptacles for pathogenic bacteria. Their frequent infections are due to peculiarities in location and structure. The lymphatic tissue of a new-born is poorly developed, but grows rapidly, reaching its climax at the tenth year. The frequent infections during this period are regarded as one of the causes of this course. A second climax may be seen in old age. The plasma cells so often present in large number in lymphoid tissue are regarded as changed lymphocytes and not as the mother cells of the lymphocytes. Whether eosinophilic myelocytes originate from adventitial cells of the capillaries of lymphoid tissue remains undecided. Reticulum cells and reticulo-endothelial cells are closely related. The reticulo-endothelial cells store small particles as dyes, coal dust and lipoids more readily than the reticulum cells. As the lymph circulates in the sinuses and lymphatics, foreign bodies and toxins are removed from the lymph nodes. There is a relation between nutrition and the amount of lymphatic tissue. It is well developed in well fed persons, and hypoplastic in the undernourished. The genuine status lymphaticus is regarded as due to congenital disposition caused by endocrine disturbances. A secondary metabolic status lymphaticus may be produced by exclusive and excessive feeding with certain proteins, and a secondary status results also from chronic infections of mucous membranes. Status lymphaticus is interpreted as a symptom of an unusual irritability of the organism of an unknown character. The causes of a

localized lymphatic hyperplasia are acute or chronic infection, producing a regenerative hyperplasia of the germinative centers and an increase of the lymphoid tissue, which is transformed into a myelic tissue in pernicious anemia and myelogenous leukemia. Alterations of the reticulum cells and reticulo-endothelial cells are produced by changes of the lymph. After injections of vital stains, swelling and proliferation of the reticulo-endothelial cells and liquefaction of the reticulum is observed. The reticulo-endothelial cells of the perifollicular sinus take up living particles like tubercle bacilli more readily than dead substances. Their subsequent necrosis instigates a regenerative proliferation. A fibrosis of the lymph nodes is the result of an atrophy of the lymphatic tissue with collapse of the reticular network. Sclerosis follows infectious processes and induration is produced by the deposition of dead particles, such as dust, with secondary proliferation of connective tissue and transformation of the reticular fibrils into collagenous fibrils. Hyalinization is caused by a transformation of tuberculous epitheloid cell proliferations into scar tissue with deposition of hyaline material into the interfibrillar spaces. The predilection of the peripheral zone for the deposition of amyloid is of unknown nature. The relation of the lymphatic organs to the endocrine system are demonstrated by the hyperplasia of the lymphatic and lymphoid tissue in exophthalmic goiter. The mesenteric lymph glands are important for the lipoid metabolism, because the reticulo-endothelial cells transform the lipoid into neutral fats. The reticulo-endothelial cells are also regarded as producers of antibodies. Lymphocytosis may be caused by hyperplasia of the lymphatic tissue, as in childhood; lymphopenia is due either to destruction of lymphatic tissue (tuberculosis, typhoid fever) or to a functional inability of the lymph glands to release lymphocytes into the lymph and the blood. The transformation of lymphatic tissue into lymphoid or reticulo-endothelial tissue, and vice versa, may occur under pathologic conditions.

W. HUEPER.

THE RELATIONSHIP BETWEEN BLOOD AND TISSUE SUGAR. BÉLA STEINER, Jahrb. f. Kinderh. **60**:309, 1925.

Steiner made simultaneous sugar tests on the blood and tissue fluid (acquired by producing a bleb with a blister plaster) of sixty children and found that healthy children had a somewhat lower tissue sugar than blood sugar. Children with diabetes (two cases) had a higher tissue sugar. Goiter of puberty, two cases of dystrophia adiposogenitalis, and two cases of Mongolian idiocy showed no marked variation between the tissue sugar and blood sugar. Fever may or may not reduce the tissue sugar. In measles there was a marked reduction of the tissue sugar, but the blood sugar remained normal. In five cases of tuberculous meningitis, the tissue sugar was reduced.

E. W. EHRMANN, Chicago.

THE ABILITY OF THE HUMAN BLOOD TO FORM LACTIC ACID FROM POLYSACCHARIDES. A. ABRAHAM and S. FRIEDBERG, Klin. Wchnschr. **5**:2264, 1926.

Glycogen, starch and dextrose are mixed with defibrinated human blood and incubated from six to eight hours at 37 C., and then examined quantitatively for lactic acid. The lactic acid production from dextrose always far exceeds that from glycogen and starch.

J. D. WILLEMS.

THE INFLUENCE OF ROENTGEN RAYS ON THE ACID BASE EQUILIBRIUM. C. v. PANNEWITZ, Strahlentherapie **24**:327, 1926.

This is a brief report of extensive investigations of the changes in the acid base equilibrium of rabbits and human beings following roentgen-ray exposure. The urine did not show any appreciable fluctuation in the H-ion concentration. The reaction of the blood appeared in two phases; directly after the treatment there was a slight acidosis which turned into alkalosis from two to five hours later. The degree depended on the part exposed; an increasing scale from extremities, ovaries and uterus, thorax and abdomen, was noted. The first phase is believed to be due to a direct roentgen-ray effect, the second phase may have its cause in a stimulation of the vagus by the products of decomposed albumins. All patients with liver disease had a reduced alkali reserve. The treatment of these patients by roentgen rays or the administration of a general anesthetic (ether or chloroform) is, therefore, dangerous.

RELATION BETWEEN HYPOPHYSIS AND GENITAL ORGANS. L. D. PODLJASCHUK, Strahlentherapie **24**:439, 1927.

This article in an intended series deals with the relation between the hypophysis and the genital organs. Eight rabbits and five dogs were treated over the right and left temporal and frontal regions. In the first group, three of five rabbits (10 weeks old) received approximately 25 per cent, 35 per cent and 45 per cent erythema doses to the hypophysis; the two remaining animals served as controls (3 aluminum, 25 cm. focal skin distance, quality of radiation 11 to 12 Wehnelt; this would correspond to a half value layer of from 1.2 to 1.4 cm. of water). After from sixty to seventy-four days, all five animals were killed. There was not any appreciable change in the gained weight; macroscopic changes could not be noticed in any organ. Section of the hypophysis showed more eosinophils than normal; the individual cells seemed larger. No stimulating effect of small doses of roentgen rays may be deduced from this result.

In the second group, two of three rabbits (7 months old) were exposed to 130 per cent erythema doses effective in the hypophysis (180 kilovolts, 4 milliamperes, 0.5 copper plus 1 aluminum, 23 cm. focal skin distance, 2 by 5 cm. field, over the temples and 4 by 6 cm. field over the frontal, one erythema surface dose per field). After seventy-two days all three rabbits were killed; one treated animal had lost in weight. Histologic section of the hypophysis showed degeneration and atrophy. Changes in the genital organs were not noticed.

The third group consists of five dogs (8 weeks old) that received from 75 to 130 per cent erythema doses effective in the hypophysis, of the same radiation as used in group 2. The heavily treated dogs were killed after fifty-eight and seventy-two days; the other and the control died after seventy-six days. The cause of death was undetermined. As a result of the treatment, the growth and development appeared delayed. The genital organs were atrophied. There seems to be a great difference between the reaction of adult and young growing animals following roentgen radiation to the hypophysis. The relation between genital organs and the pituitary gland requires further investigation.

E. A. POHLE.

A STUDY OF THE SEDIMENTATION TEST OF BLOOD CORPUSCLES. POUL GÖTZSCHE, Ugeskr. f. Laeger **89**:223, 1927.

Eight hundred and sixty-three determinations on the sedimentation of blood corpuscles were carried out on 327 children, ranging in age from 2 to 16 years,

and were compared with the tuberculin reaction. The determinations may be summarized as follows: 1. Maximum sedimentation of blood corpuscles in normal blood is 7 mm. per hour. 2. Of the sixteen various diseases studied, the sedimentation is greatest in fistulous and abscess processes. 3. In rickets and exudative diathesis without eczematous eruption, the sedimentation is normal. 4. In involvement of the bronchial and mesenteric glands, the sedimentation is faster than in peripheral adenitis. 5. No definite correlation exists between positive Pirquet reactions and sedimentation.

The value of the sedimentation test is to determine whether an occult disease condition is present or to help prognosticate the course of a disease.

SCHLUTZ, Minneapolis.

Acute Infections

THE PERSISTENCE OF STREPTOCOCCUS SCARLATINAE IN THE THROAT OF CONVALESCENT SCARLET FEVER PATIENTS. EDITH E. NICHOLLS, Am. J. Hyg. **7**:84, 1927.

Patients convalescent from scarlet fever are still infectious three weeks after the onset of the disease.

[ARCH. PATH.]

BLOOD SUGAR CURVES IN EPIDEMIC ENCEPHALITIS. J. KASANIN and G. P. GRABFIELD, Arch. Int. Med. **37**:102 (Jan.) 1926.

An increase in the sugar content of the cerebrospinal fluid in encephalitis has been noted by a number of observers. In the cases presented, the sugar metabolism was studied by means of the blood sugar curve. It has been shown that the sugar curve in encephalitis tends to be higher than normal and also that there is a quantitative relationship between the sugar content of the blood and of the spinal fluid in epidemic encephalitis. Thalheimer and Updegraff believe that there is a threshold level for the entrance of sugar into the spinal fluid similar to that maintained by the kidneys for sugar in the urine.

The authors studied twenty-four blood sugar curves in seventeen patients by the blood sugar tolerance test of Janney and Isaacson. The Wassermann reaction was negative in all cases. None of the patients had glycosuria. Four of the seventeen patients were in the acute febrile stage. The authors state that in none of the cases was there any question as to the correctness of the diagnosis. The change in blood sugar curve was so constant that it seems reasonable to conclude that there is a fundamental disturbance of the sugar metabolism in encephalitis, and also that the change in sugar metabolism persists in patients suffering from the mental sequelae of encephalitis. The authors thus conclude that this disturbance is associated with the underlying pathology of the disease.

WAGGONER, Philadelphia.

A NOTE ON THE COMPLICATIONS OF PNEUMONIA IN INFANTS AND CHILDREN. LEWIS WEBB HILL, Boston M. & S. J. **196**:107 (Jan. 20) 1927.

The records cover 1,187 cases in the Infant's Hospital and 774 cases in the Children's Hospital during the years 1915 to 1925 inclusive.

Of the former, 341 patients (28 per cent) had otitis media; forty-seven (4 per cent), empyema; twenty-four (2 per cent), pyelitis; twelve (1 per cent), acute nephritis. There were five cases each of unresolved pneumonia, infectious diarrhea, pneumococcic meningitis, and retropharyngeal abscess; four cases each of

influenzal meningitis and erysipelas; three cases of peritonitis; two cases each of purulent pericarditis, dry pericarditis, encephalitis with hemiplegia, pyopneumothorax, and pleural effusion (sterile); one case each of abscess of the lungs, endocarditis and pneumothorax. At the Children's Hospital were 119 cases (15 per cent) of otitis media; forty-three cases (5 per cent) of empyema; sixteen cases (2 per cent) of unresolved pneumonia; two cases of acute nephritis; one case each of pyelitis, abscess of the lungs, pneumothorax, pneumococcic meningitis, influenzal meningitis, peritonitis, purulent pericarditis and myocarditis. At the Infant's Hospital, there was a yearly variability in cases of otitis media of from 11 to 50 per cent, and at the Children's Hospital of from 4 to 45 per cent, and of the cases of empyema from none to 11 per cent at the Infant's Hospital and from 0.6 to 8 per cent at the Children's Hospital.

GENGENBACH.

THE VIRULENCE TESTING OF THE DIPHTHERIA BACILLUS AND ITS PRACTICAL APPLICATION. C. C. OKELL and H. J. PARISH, J. Hyg. **25**:355, 1926.

The authors recommend that the virulence of "morphological diphtheria bacilli" be tested by the intradermic injection of a preparation into guinea-pigs.

ARTHUR LOCKE.

WHAT CONCLUSIONS CAN BE DRAWN FROM THE DIFFERENT DEGREES OF THE DICK SKIN TEST REACTIONS? BELA JOHAN, J. Immunol. **13**:31, 1927.

When reading results of Dick skin tests, it is not enough to classify them only as positive or negative reactions. Differences in degrees of positive reactions must also be noted. A sharp dividing line is not present between positive and negative reactions; there are borderline reactions. The interpretation of these often depends on the physician who reads the reaction. When these borderline reactions are numerous, a larger possibility of error is introduced.

The interpretation of the Dick skin tests is most difficult in the ages in which the weak (+ positive) reactions are numerous, i. e., in the older age groups, whereas, in the first years of life (when the weak reactions are comparatively few) the readings can be made with greater accuracy.

Further studies and more experience are necessary before it can be definitely ascertained whether or not the dividing line employed at present to separate the positive from the negative reactors coincides in reality with the dividing line that separates the scarlet fever immune from the scarlet fever susceptible.

The determination of the different degrees of Dick skin reactions has a practical value in active immunization. The author found that weak positive reactors require less toxin to give an immunity, then strong positive reactors.

[ARCH. PATH.]

PNEUMONITIS CAUSED BY VINCENT'S ORGANISM. JACOB M. CAHAN, M. J. & Record **125**:194 (Feb. 2) 1927.

The author reports a case of pneumonitis in a child, aged 8. A smear taken from the larynx showed presence of Vincent's organism. The patient was given 3 Gm. of neoarsphenamine intravenously. He began to improve in forty-eight hours. The chest was clear of adventitious signs in ten days. A laryngeal smear taken at that time was negative for Vincent's organism.

WILLIAMSON, New Orleans.

DIPHTHERIA TOXOID AS AN IMMUNIZING AGENT. J. G. FITZGERALD, Canad. M. A. J. **17**:5, 1927

The author gives a brief résumé of the present day opinion regarding antigens in general and a short historical sketch of the development of first, the toxin-antitoxin and later, the toxin treated with liquor formaldehydi or toxoid, as immunizing agents in diphtheria.

In preparation of the toxoid, a toxin containing not less than 400 minimal lethal dose per cubic centimeter is used. Liquor formaldehydi is added to a concentration of 0.3 per cent. The mixture is heated at 37 C. for from one to four weeks until detoxification is complete. Detoxification is considered complete when 1:5 and 1:25 dilution show a skin reaction, of 5 mm. or less, in a guinea-pig, and the undiluted material a reaction of 12 mm. or less. The antigenic potency is tested by noting the toxin neutralizing power in skin and the ability to protect against five lethal doses of toxin.

During the period from July 1, 1926, to February, 1927, between 100,000 and 120,000 persons resident in the Canadian provinces have received diphtheria toxoid.

Certain persons develop local or general reaction after receiving toxoid. These may be detected by injecting 0.1 cc. of a 1:20 dilution of toxoid. If a reaction, measuring more than ½ inch (1.27 cm.) in diameter, develops within three days, it is recommended that diphtheria toxoid should not be given.

The evidence from these examinations shows that more than 70 per cent of those given two doses of toxoid have developed immunity in less than three months.

MOORE, Omaha.

HERPETIC DISEASES. J. R. PERDRAU, Brit. J. Dermat. **39**:1 (Jan.) 1927.

Perdrau outlines the main results of the recent researches on herpetic diseases, with comments based on experiments of his own. He states that the virus of herpes is neurotropic, and speaks of a lethargica strain, the incubation period of which is constantly shorter than that of a dermatropic strain. He believes that the two strains are different species of the same virus possessing fixed characters of their own. He states that various workers have demonstrated that the virus of herpes may be carried by presumably healthy persons in saliva and nasal secretions. He summarizes the principal points of his article as follows:

1. Herpes simplex or febrilis, whatever its situation in the body, is caused by a living agent or virus, which lives normally a semisaprophytic existence on the mucous surfaces of most persons. It is mildly pathogenic to man, and is probably responsible for at least some cases of zoster by local invasion of the central nervous system.

2. Some cases of zoster either are caused by a similar action of the virus of varicella or at least contain that virus in their characteristic skin lesion.

3. A different strain of the virus of herpes, pathogenic to man, is the causative agent of epidemic encephalitis.

THE PATHOLOGICAL RELATIONSHIPS OF THE HERPETIC DISEASES FROM THE CLINICAL STANDPOINT. A. C. ROXBURGH, Brit. J. Dermat. **39**:13 (Jan.) 1927.

From the clinical standpoint, Roxburgh discusses under one heading herpes simplex, febrilis or recurrens, on whatever part of the body it occurs; under another, herpes genitalis, although he believes it is possibly the same disease;

and under a third, herpes zoster. He discusses, with references to the literature, the fact that herpes simplex and zoster are different diseases. He states that clinical evidence points to the fact that herpes febrilis is an infection and adds that there does not seem now to be any reasonable doubt that herpes simplex is caused by a definite ultramicroscopic virus which has been found in the sputum of patients with herpes, and which may remain after the herpes has healed, giving rise to recurrences, or that such patients may act as carriers. He discusses the natural mode of infection and immunity, and cites the arguments summed up by Doerr for and against the identity of herpes and epidemic encephalitis. He discusses the etiology of herpes zoster and considers, with references to some of the literature, the possibility of a relationship between some cases of zoster and varicella. He concludes that a large number of cases of spontaneous zoster are due to the same virus as varicella, and that this also applies to zoster in patients taking arsenic, and in patients with some other preexisting disease, such as general paralysis. He concludes his article with questions concerning the identity of zoster and varicella, and with the remark that there is, perhaps, as has been suggested, a specific zoster virus, apart from the varicella virus, which accounts for some of the cases not due to the varicella virus.

CONTRIBUTION TO THE DISCUSSION ON "THE PATHOLOGICAL RELATIONSHIPS OF THE HERPETIC DISEASES." S. P. BEDSON, Brit. J. Dermat. **39**:26 (Jan.) 1927.

Bedson has been working on the interrelationship of the virusses of herpes, zoster and chickenpox, and has also been investigating the nature of filtrable viruses. He has isolated five strains of the virus of herpes — two from labial herpes in pneumonia, two from spontaneous labial herpes, and one from herpes of the buttock — and states that all five of them cross-immunize. His results point to the virus of herpes as being different from that of zoster, in keeping with the majority of published observations. He cites cases, with experimental data, which he believes suggest that the fluid from the vesicles of certain bullous skin conditions, other than herpes and zoster, contains an agent belonging to the group of so-called filtrable viruses, capable of producing lesions in the plantar epidermis of guinea-pigs, and bearing a close resemblance to those evoked by the inoculation of the viruses of herpes and foot and mouth disease. The nature of these viruses still remains an open question. He states that the virus of herpes is always the same in the herpes vesicles in such conditions as pneumonia, malaria and cerebrospinal meningitis, and that the vesicles of zoster appear after nerve lesions produced by the virus of anterior poliomyelitis, arsenic poisoning, and injury to the nerve cells of the posterior root ganglion. From these facts he concludes that both viruses either are widespread in the human race, leading a saprophytic life in human tissue, or are of the nature of autolytic enzymes which can be produced de novo in response to cell injury by a variety of different agents.

WIEN, Chicago.

ACTIVE IMMUNIZATION AGAINST MEASLES. R. DEBRÉ and others, Ann. de méd. **20**:343, 1926.

The blood of patients with measles was taken on the onset of the eruption and filtered, and 0.0025 cc. was diluted with physiologic salt solution, injected subcutaneously in children from 2 to 4 years of age. Fever, catarrhal symptoms and sometimes a slight eruption usually appeared between the seventh and tenth day after the infection. When 0.00125 cc. of blood was injected, a visible

reaction did not occur, but on the third or fourth day leukocytosis appeared, followed by leukopenia, which was succeeded by a second leukocytosis. A second injection of 0.025 cc. of blood was given in three weeks. Hundreds of children have been vaccinated successfully by this method without any reactions. The duration of the immunity has not been determined.

[ARCH. PATH.]

A CONTRIBUTION TO THE STUDY OF AMEBIC DYSENTERY AND ITS TREATMENT IN CHILDREN. E. DEBBAS, (Cairo), Arch. de méd. d. enf. **30**:257, 1927.

Debbas has had unusual opportunities for the study of dysentery in Egypt, where the disease has undoubtedly been endemic for centuries. Although both forms are found among children, the amebic type is by far the more common. From July, 1924, to December, 1925, sixty-three cases were studied, these invasions being confirmed by the detection of amebas and amebic cysts in the stools. A great many other cases, considered by Debbas as belonging to this group, were not included because the stools were normal. As a matter of fact, it is extremely difficult to secure suitable material for examination among primitive people, the life cycle of the ameba being limited and differentiation after death of the parasite almost impossible. Among the etiologic factors with older children, contaminated water, fruits and vegetables are believed to be the most important; in the case of nurslings, infection may be carried by soiled hands, contaminated milk or by raw fruits, which even infants are allowed to suck. With no ordinances governing the collection, sale and distribution of milk in Cairo, this food is unquestionably the chief source of dysenteric disease throughout the city and environs. Another ubiquitous agent in the propagation of dysentery is the common house fly, which swarms in great numbers, particularly during the summer months. Contrary to the views advanced by many authors regarding the immunity enjoyed by infants under 1 year, Debbas affirms that the observations of Petzetakis (Alexandria) are correct, and declares that numerous patients have been presented in his clinic before the age of 6 months. Of the sixty-three cases reported in his monograph, fifteen were under 1 year, or approximately 24 per cent. Contrasting this with his experience in bacillary dysentery, he finds that in many years of pediatric practice in Cairo he has not encountered fifteen cases of the latter type in children under 6 years.

Both acute and chronic forms are found in early life, but the acute type predominates, fourteen of the fifteen cases already noted being of this variety. Both forms are carefully described and case reports included. Among complications of amebic dysentery we find that the one most dreaded in the adult, abscess of the liver, is rarely if ever found in the infant. Meningo-encephalitis likewise is most uncommon, as is also cardiac involvement. The sole complication of importance is hypothrepsia, which usually follows the febrile gastro-intestinal type; unless vigorously combated, it inevitably leads to athrepsia. Bronchopneumonia is an occasional complication. Prognosis on the whole is good if the patient is treated early. Emetine, given intramuscularly or subcutaneously, is considered a specific by Debbas. In grave cases it is given intravenously. Intolerance to this drug, manifested by cyanosis, vomiting and collapse, is sometimes noted. It is recognized that the action of emetine on the encysted amebas is not as satisfactory as on the free parasites, and occasionally patients with cases in the chronic stage are wholly unaffected by this drug. In these invasions, rectal irrigation with weak solutions of neoarsphenamine has been recommended by Ravaut. The author prefers stovarsol as

a complementary agent with emetine, and in forty-nine of the sixty-three cases in his series he obtained excellent results. He administers the drug orally. This combined treatment is suggested to those responsible for the management of this formidable scourge of the tropics.

AMESSE, Denver.

A CASE OF SEPSIS IN INFANCY. A. F. CANELLI, Clin. pediat. **9**:275 (March) 1927.

The author reports a case of sepsis of eighteen days' duration in a child, aged 8. The important conditions found at the clinical examination and at autopsy were leukopenia, agranulocytic eosinophilia, dermatomyositis, osteomyelitis, osteoperiostitis, destruction of the nuclei of ossification, bronchopneumonia, "cor villosum," ecchymoses into all the serous membranes and albuminous myocarditis.

ZAMBARANO, Northville, Mich.

CLINICAL AND ETIOLOGIC STUDY OF SODOKO (RAT-BITE FEVER). M. GERBASI, Pediatria **35**:139, 1927.

Gerbasi's patient, a boy of 8, had gone to sleep, holding in his left hand a small piece of cheese. He was awakened during the night by a sudden pain and noticed blood on his right hand. The relatives then noted two minute holes in the first phalanges of the ring and little fingers. Blood was seen to exude. Alcohol was applied.

The swelling of the fingers with a corresponding axillary adenopathy and fever began some eight or ten days after the accident. The temperature gradually rose to 39.5 C. and subsided by lysis in ten days. It returned in two days and lasted a week and a half. It returned for a third time, after an afebrile period lasting five days. The child was then brought to the clinic. He was poorly nourished. Areas of light red erythema, disappearing on pressure, irregular in outline, and about 5 or 6 cm. in diameter, were on the face; similar areas were present on the chest anteriorly. The ulnar half of the right hand was moderately edematous; in the right axilla, two glands were felt; they were hard and elastic, were easily movable and were covered by normal skin; together they were the size of a walnut.

The disease ran an intermittently febrile course. Animal inoculation with the blood and urine of the patient was negative. Cultures were negative Not until two months after the child was first seen was the author able to identify the causative organism. Microscopic examination of the axillary lymph glands at this time revealed a few spirochetes, about 8 or 10 microns in length.

Neoarsphenamine was given intravenously in doses of from 0.05 to 0.3 Gm., which proved successful.

PRIMARY B. PYOCYANEUS ARTHRITIS IN EIGHT MONTH INFANT. A. PINELLI, Pediatria **35**:147, 1927.

The infant presented an acute arthritis of the left shoulder joint. There was swelling with definite fluctuation, associated with fever and sweats. Aspiration and culture disclosed a purulent arthritis due to *B. pyocyaneus* in pure culture.

Treatment by repeated aspirations and autogenous vaccines intramuscularly was completely successful.

CEREBRAL COMPLICATIONS OF PERTUSSIS. A. BERARDI, Pediatria **35**:188, 1927.

Two cases of pertussis, more severe than usually encountered in Southern Italy, are reported. In the first case, after many convulsive seizures, a right

facial general paralysis with strabismus, general paralysis of the right upper extremity and clinical signs of meningeal irritation gradually developed. Repeated lumbar punctures disclosed a spinal fluid under pressure, but was essentially normal.

In the second case, a right facial general paralysis with paralysis of the left lower extremity and slight rigidity of the neck developed suddenly after three convulsions. The spinal fluid here was also under pressure, but was essentially normal.

Both children were treated by lumbar punctures and vaccine. Both completely recovered from the disease and the complications.

SALA, New York.

A CASE OF CUTANEOUS-SUBCUTANEOUS NECROSIS FROM A DIPHTHERITIC INFECTION. M. PERGOLA, Riv. di Clin. Pediat. **25**:73, 1927.

A child of 2 years who was sick with measles, developed an area of necrosis in the skin of the right inguinofemoral region. The patient died. A pathogenic *Corynebacterium* was isolated and studied as the probable etiologic agent. The author concluded that the organism was an atypical diphtheria bacillus, basing his conclusion largely on the immunity it conferred against diphtheria toxin.

HIGGINS, Cincinnai.

PREVENTION OF SCARLET FEVER. PRELIMINARY REPORT. E. REICH and J. TEICHMANN, Wien. klin. Wchnschr. **40**:521 (April 21) 1927.

The authors investigated the contagiousness of scarlet fever by determining the incidence of growth of *Streptococcus hemolyticus* on the surfaces of horse blood plates after patients or convalescents had coughed on them. More than 60 per cent of the patients showed a positive culture, with many colonies, during the first two weeks of the disease. As the symptoms subsided and during convalescence, the number of positive cultures and the number of colonies decreased markedly. However, convalescents having negative plates by the coughing method showed growth of hemolytic streptococci in cultures of tonsil smears. Reich and Teichmann conclude that the bacterium becomes dislodged from the throat with increasing difficulty during recovery from scarlet fever.

OLMSTED, Seattle.

SCARLATINA VIRUS. A. SMIRNOWA-ZAMKOWA, Virchows Arch. f. path. Anat. **261**:821, 1926.

In the tissues and bile of persons who died from scarlet fever, the author had seen minute oxyphil bodies which could be stained with strong solutions of eosin. In the belief that these bodies might be the actual virus that prepares the soil for the streptococcus universally present in the disease, attempts at cultivation were made. Bile from the gallbladder was cultured in sugar broth which was kept in the incubator for eleven days without transfer, for the purpose of killing the streptococci present. The broth culture, which contained dead streptococci and their toxin, was injected intravenously into rabbits, from which blood was taken at intervals of six, twelve, twenty-four and forty-eight hours, and injected serially into other rabbits. In rabbits of the third passage, the blood contained numerous minute, highly refractile bodies, some of which were free, but most of which were attached to the surface of red corpuscles. These bodies could be stained with eosin. Guinea-pigs inoculated with second passage rabbit's blood contained similar bodies. With eosin, followed by

Giemsa's stain, a few larger basophilic bodies, each with a single central or two polar oxyphil bodies, were also seen. When blood containing the bodies was inoculated into broth, multiplication occurred in the first four or five transfers and then ceased. The author believes that the bodies described by him may be the actual virus of scarlatina.

GALLBLADDER IN SCARLATINA. A. SMIRNOWA-ZAMKOWA, Virchows Arch. f. path. Anat. **261**:832, 1926.

In 1902, the author had called attention, as the result of his studies of the pathology of scarlet fever, to the belief that the alimentary tract is the primary seat of the infection. Paying more especial attention to the gallbladder in the present investigation, he found streptococci in the mucosa in all except two of thirteen cases. Definite reactive inflammatory changes were present in the gallbladder wall in only three. The oxyphil bodies described by the author could be seen in the wall. He believes that his present observations confirm his earlier ones of the primary invasion of the alimentary tract, and that streptococci reach the gallbladder from the gastro-intestinal tract by way of the lymphatics.

O. T. SCHULTZ.

THE DICK TEST AS PROOF OF IMMUNITY TO SCARLET FEVER. THIRD COMMUNICATION. E. NOBEL and F. SCHÖNBAUER, Ztschr. f. Kinderh. **42**:248 (Nov.) 1926.

Forty-two children with various internal and infectious diseases were tested by the Dick method before, during and after the sickness. In thirty-nine patients the outcome of the test was not altered, thus pointing to the specific connection between scarlet fever and the Dick test. In three of the forty-two cases the reaction was negative — in two definitely and in one indefinitely.

DISEASES OF THE CENTRAL NERVOUS SYSTEM FOLLOWING VACCINATION. ELEONORE FIEDLER, Ztschr. f. Kinderh. **42**:336 (Nov.) 1926.

The author reports three cases of encephalitis in connection with inoculation against smallpox in May, 1925. The children came from the same vicinity; one died and two recovered, with residual symptoms. Epidemic encephalitis was not observed at that time in the region concerned. Up to the present, the results of fifty-five cases of diseases of the central nervous system after inoculation, including the author's have been published, and a causative connection between the disease and the inoculation cannot be denied in a survey of the time relations. As to the type of this connection, nothing can be said conclusively. It is safe to say that it was not a vaccine encephalitis. Against the possibility of an activation of an epidemic encephalitis is the great difference in the disease picture and the observations of Bastian. It is probably not an activation of a uniform but unknown causative agent. The activation of entirely different causative agents in the individual cases remains as the most probable possibility. As supporting evidence for this possibility of activation is the obvious diminution of the power of resistance at present for a definite group of viruses. It should be emphasized that there was no uniform virus for all of the cases. The occurrence of injuries due to vaccination should never be passed over in silence, and it is an urgent matter for physicians to call attention to them for the purpose of scientific study. The occurrence of these rare complications should not be considered as evidence that inoculation is inherently harmful. To avoid the possibility of injury following inoculation,

only healthy children should be inoculated, inoculation should be postponed at the time an epidemic of disease of the central nervous system exists, lymph should be used which is not too strong and only a few scratches should be made.

THE DICK TEST AS A PROOF OF IMMUNITY TO SCARLET FEVER: FOURTH COMMUNICATION. HUBERT KUNZ and EDMUND NOBEL, Ztschr. f. Kinderh. **42**:372 (Nov.) 1926.

The Dick test was applied to 444 delivered and nondelivered women, more definitely, to 327 lying-in women, who, with few exceptions, were tested on the day of or the day after delivery, at the latest within forty-eight hours, and to 117 nondelivered women, who were tested from several weeks up to one day before delivery. The reaction to the test was negative in 392 cases, and positive in 52 cases. Among the 444 women, 69, or 16 per cent, had had scarlet fever, according to their history. Of the 52 patients who had a positive reaction to the test, 4, or 6 per cent, had had scarlet fever. Seventy-four per cent of the women whose reaction to the test was negative did not have a history of scarlet fever. In 32 (8 per cent) of the women with a negative reaction and in 12 (31 per cent) with a positive reaction, puerperal fever occurred.

The incidence of puerperal fever among the delivered and nondelivered women was as follows. In the women who reacted negatively, 9 per cent of the delivered and in due time 6 per cent of the nondelivered women had puerperal fever, while 21 per cent of the delivered and 31 per cent of the nondelivered women later had puerperal fever.

In many cases there seems to be an etiologic connection between scarlet fever and puerperal sepsis. It is recommended that the same precautions be used against puerperal sepsis as are used against scarlet fever, preliminary immunization, active or passive, by the use of Dick or Dochez serum.

Seventy-four newly born babies reacted negatively to the Dick test, with one exception. The mother of the child reacted positively, and died of puerperal sepsis.

SCARLET FEVER AND SEPSIS IN ENGLISH MEDICAL STATISTICS. CLEMENS PIRQUET, Ztschr. f. Kinderh. **42**:379 (Nov.) 1926.

Pirquet compared English statistics for the years from 1912 to 1920 in relation to fatal cases due to pyemia, septicemia and scarlet fever. There was a marked similarity in the three curves especially in those showing the figures for the years from 1912 to 1915. It is possible that the causative agents of scarlet fever, pyemia and septicemia are of related origin in streptococci.

EMERSON, Boston.

ERYSIPELAS TREATED WITH PROTEIN INJECTIONS. J. U. GERDES, Ugesk. f. Laeger **89**:210, 1927.

This is a report of ten cases of erysipelas, eight of the face and two involving the extremities, treated with a nonspecific milk preparation. The dose is 10 cc. intramuscularly given every day. From three to four injections are generally sufficient to bring about favorable results.

The fever and eruption subsided rapidly. Convalescence started within three or four days.

SCHLUTZ, Minneapolis.

Postvaccinal Encephalitis. L. Bouman, Nederl. Tijdschr. v. Geneesk. **71**:1980, 1927.

This is a summary of the results obtained in the microscopic investigation of the brains in cases of postvaccinal encephalitis, compared with those of cases of epidemic encephalitis. In agreement with other investigations, the cases of encephalitis epidemica were characterized by: (1) thick layers of lymphocytes and a certain kind of plasma cells in the perivascular lymph spaces; (2) neuronophagia by glia cells, of which only a few were changed into granulated cells; (3) preference for the gray substance; (4) diffuse spreading, and (5) preference for the brain trunk. The brains of patients with postvaccinal encephalitis showed a microscopic picture that in all its characteristics differed from that found in epidemic encephalitis. The characteristics of the brains of patients with postvaccinal encephalitis were: (1) accumulations of microglial granulated cells outside the perivascular lymph space in the nervous tissue itself; (2) no neuronophagia; (3) strong preference for the white substance; (4) spreading in concentrated heaps, and (5) preference for the hemispheres.

Van Creveld, Amsterdam.

Chronic Infections

Intravenous Iodides as an Adjunct to Syphilitic Therapy. L. L. Schwartz and George J. Busman, Am. J. Syph. **1**:51 (Jan.) 1927.

These authors found that patients who responded poorly to the usual methods or in whom the usual methods were contraindicated did well when sodium iodide was given intravenously. Doses of from 25 to 100 cc. of a 10 per cent solution were given daily.

Bone Changes in Congenital Syphilis. Janvier W. Lindsay, Clarence Rice and Maurice A. Selinger, Am. J. Syph. **1**:118 (Jan.) 1927.

The authors review ninety-four cases and describe the roentgen-ray examinations. Eighty-five per cent of the children having definite lesions of the bones were below 1 year of age. Of the patients below 1 year, 75 per cent showed lesions of the bones. The lesions can be grouped in the following way as to time of development: early lesions: (1) periositis; (2) destructive lesions; (3) osteitis and periostitis; (4) osteochondritis; (5) dactylitis. The flat bones were not thoroughly studied. Late lesions: (1) osteitis; (2) periarticular infiltration.

More than one type of lesion may and often does exist. Patients who have marked periostitis at one examination may at a later examination have a negative roentgenogram, even without treatment. But the late lesions, i. e., osteitis, do not clear up even with treatment. The lesions are named in the order of their frequency.

McBride, Iowa City.

Unrecognized Cases of Congenital Syphilis. Stuart V. Goldhurst, Brit. J. Dermat. **39**:66 (Feb.) 1927.

Goldhurst points out that the work done in attempting to stamp out syphilis, and the knowledge that vigorous treatment of the pregnant syphilitic mother means nonsyphilitic offspring, makes it incumbent that any weak links in the chain should be recognized. He believes that a large number of cases of congenital syphilis in children are missed owing to some accompanying and more obvious trouble. He appends a list of twenty-seven cases to his article, collected over a period of three years from 2,000 admissions to Queen Mary's

Hospital for Children, Carshalton. Most of these patients were sent to the hospital with some gross lesion, in many cases tuberculous or simulating tuberculosis and in no case was the presence of congenital syphilis noted. When the Wassermann test was applied, the patients were all found to have positive reactions, and the results obtained from antisyphilitic treatment confirmed this diagnosis.

WIEN, Chicago.

MILIARY TUBERCULOSIS IN INFANCY. A. GISMONDI, Pract. pediat. **3**:187 (Nov.-Dec.) 1926.

Miliary tuberculosis in infants is protean in its manifestations. According to the nature of the pathologic process, it occurs in the acute, subacute and chronic forms. The chronic or subacute forms belong to the class designated as chronic generalized tuberculosis by Marfan. The onset is insidious, and the course of the disease is progressively downward. The localization of the process is not definite at first. The acute form is fulminating and may be localized in the lungs or meninges. The evolution of this type is rapidly fatal. Cyanosis, dyspnea and rapid loss of weight in any nursing infant should bring to mind the possibility of a miliary tuberculosis, and a careful investigation is not only justified, but indicated.

The author believes that the tuberculin reaction has little value in these patients. A positive reaction often is obtained only in the earliest stage of the disease. It is of value in doubtful cases. A negative reaction is not always conclusive, and other methods of diagnosis must be resorted to. A search for tubercle bacilli in the sputum and excreta should be made. The complement-fixation test may help. Roentgen-ray examination of the lungs is of distinct benefit in the majority of cases.

ZAMBARANO, Northville, Mich.

EXPOSITIONAL AND DISPOSITIONAL CONDITIONS IN DIFFERENT FORMS OF TUBERCULOSIS IN CHILDHOOD. ALFRED WISKOTT, Ztschr. f. Kinderh. **42**:286 (Nov.) 1926.

There is a far-reaching difference between the condition of infection in miliary tuberculosis in children and that in pulmonary tuberculosis and scrofula. In the first, the conjectural source of infection is to be sought in blood relationship in about one fourth of the cases. The infecting disease in the parents is of a mild nature, and the majority of children become infected within the first three years of life. In the other two forms of tuberculosis — scrofula and pulmonary tuberculosis — to which particular attention is paid in this paper, the source of infection is intrafamilial in one half of the cases; the infecting phthisis in the parents is on the average more severe, and the relation of the age of the infected child to the frequency of intrafamilial infection is of little importance. The chief factors of infection by exposure to near relatives, especially the severely sick, with massive infection or lasting reinfection and superinfection, play only a subordinate rôle for the genesis of miliary tuberculosis, but they are of significance for the occurrence of pulmonary tuberculosis and for scrofula. An evaluation of the factor of disposition in intrafamilial infection arising from blood relationship cannot be made on account of the impossibility of excluding the influence of exposure. The degree of purely familial taint derived from adults with tuberculosis or from ascendants who do not have contact with the child corresponds accurately in percentage in the case of miliary tuberculosis and scrofula to that found in a controlled series of cases of unimportance as far as tuberculosis goes. In the case of

pulmonary tuberculosis, however, the value is some degrees higher than in the control group.

From the comparison of other pertinent factors, such as average number of cases of tuberculosis in ascendants per family and in the control series, and such as the frequency of familial tuberculosis through three generations, only expositional relations between the cases of tuberculosis in the related adults and children with tuberculosis could be demonstrated. In all the forms of tuberculosis studied, female patients were in the great majority in the age group from 10 to 15 years; as to scrofula, females were shown to be in a majority at all ages. A comparison of the morbidity and mortality of tuberculosis of children in the same family shows that within the individual groups of tuberculosis the forms to be met with are frequent. In miliary tuberculosis a series of cases could be found in which one or more brother or sister beyond the characteristic age of predilection succumbed without foregoing debilitating disease and without an intrafamilial source of infection; this would appear to signify that there was an inability to limit the primary complex in the sense of a familial capacity for resistance against tuberculosis.

Any outspoken disposition of the organs to tuberculosis could not be established. The author thinks that there is an endogenous disposition of children to tuberculosis, but that the form and course of tuberculosis in childhood depends on different hereditary factors.

EMERSON, Boston.

A FURTHER COMMUNICATION ON TUBERCULOSIS IN INFANTS AND CHILDREN. A. GHON and H. KUDLICH, Ztschr. f. Tuberk. **46**:391, 1926.

In the year 1925, autopsies were performed on forty-one children with definite tuberculous lesions in the Pathologic Institute of the German University in Prague. The ages ranged between 1½ months and 13 years. Thirty-eight had a primary pulmonary infection; in one case the portal of entrance could not be determined; one case had a primary focus in the middle ear (reported in a separate publication), and in one case the primary infection was in the region of the cervical lymph drainage. The distribution of the primary foci in the lungs was much the same as that reported in earlier papers. In twelve cases the primary focus was caseated; in 5, caseated and softened; in 4 it was represented by a cavity with caseated masses; in 3, a fresh cavity; in 5, a smooth-walled cavity; in 1, a cavity with chalky contents; in 1, an encapsulated cavity, and in 1 a smooth-walled cavity with indurated wall. In 2 cases the primary focus was cheesy-chalky; in 1 case cheesy-chalky and encapsulated; in 1 case cheesy, softened and encapsulated; in 1 case cheesy and encapsulated; in 1 case cheesy and indurated, and in 1 case chalky. In infants signs of healing were not observed. The youngest patient who showed an anatomically healed focus was a girl, aged 1¼ years. All foci were located in the subpleural layers. Of the thirty-eight cases with primary pulmonary infection, thirty-four showed hematogenous propagation. Twenty-nine of the thirty-eight pulmonary cases showed macroscopically tuberculous changes in the lymph nodes of the bronchomediastinal lymph drainage, which extended to the venous angles.

MAX PINNER.

EXPERIENCE WITH "SANOCRYSINE" IN THE CHILDREN'S HOSPITAL AT GRONINGEN. G. SCHELTEMA and H. E. ROOKMAKER, Nederl. Tijdschr. v. Geneesk. **71**:702, 1927.

In fifteen patients with pulmonary tuberculosis "Sanocrysin" was used. Four of the patients had miliary tuberculosis, and they did not show any improvement.

Among the other patients there were seven in whom improvement could be observed now and then, but it could not be demonstrated objectively. In the remaining four patients, however, whose cases are fully described, the improvement was remarkable, clinically as well as roentgenologically, and it was obtained within an unusually short time. The treatment caused no special inconvenience.

VAN CREVELD, Amsterdam.

TUBERCULIN TREATMENT IN BRONCHIAL ASTHMA. C. R. ØSTERGAARD, Ugesk. f. Laeger **89**:24, 1927.

While not showing any tabulated results, the author has demonstrated to his satisfaction that a foreign protein therapy is not so effective in the treatment of bronchial asthma as is a tuberculin therapy. The tuberculin used is an albumose free preparation produced by Hoechst. The initial dose is 0.0001 Gm., which is gradually increased to 0.10 Gm.

Of the twenty-eight patients tabulated, ranging from 10 to 62 years and including both sexes, 70 per cent were definitely improved. The author also quotes the results of Storm von Leeuwen, who reports his results in 300 patients treated with tuberculin and finds definite improvement in 78 per cent. No untoward symptoms occur during the course of treatment.

SODIUMTHIOSULPHATE INFECTIONS TO COMBAT COMPLICATIONS ARISING IN ARSPHENAMINE THERAPY. AAGE KRISTJANSEN, Ugeskr. f. Laeger **89**:154, 1927.

Sodiumthiosulphate was used in 0.10 Gm. doses to combat symptoms of arsphenamine intoxication in infants and dermatitis in adults, from 0.6 to 1 Gm. being given daily.

The author cites cases to show the results of this therapy. He thinks the sodiumthiosulphate is nontoxic in the small doses used and that it has no influence on the Wassermann reaction.

SCHLUTZ, Minneapolis.

Internal Diseases

STUDIES ON DIABETES INSIPIDUS. I. H. BOURQUIN, L. C. BENESH and M. O. LANAM, Am. J. Physiol. **79**:362, 1927.

Diabetes insipidus was produced in dogs by the cauterization of the mammillary bodies at the floor of the third ventricle. Caused in this way, it is to be regarded as an irritation rather than a deficiency phenomenon, as it followed slight, but not severe, injury.

The following evidence is deduced for the view that the diuresis is due to the production of some substance locally as a result of the injury:

That the hypophysis is not responsible is shown by the fact that when it is excised without injury to the proper area of the floor of the third ventricle diabetes insipidus is not produced. If in such animals that area is injured, diabetes insipidus ensues.

The thirst of diabetes insipidus is secondary to the diuresis, since this occurs in animals restricted to their preoperative water intake, and such animals quickly give evidence of desiccation.

Independence of the phenomenon of the autonomic and somatic nervous systems is shown by the fact that typical diabetes insipidus caused by ventricular irritation occurs after the transection of the spinal cord at the level of the eighth cervical vertebra, double vagotomy below the diaphragm and paralysis of the parasympathetic nervous system by atropine.

With cross transfusions between severely diabetic and normal animals, brief diuresis was observed in some cases. This result was never obtained in the cross transfusion of normal animals.

H. E. Eggers.

The Incidence of Syphilis in Bronchial Asthma. Maximillian A. Ramirez and A. V. St. George, Am. J. Syph. **1**:59 (Jan.) 1927.

A review of the histories of 1,000 asthmatic patients revealed seventy-eight of them to be syphilitic. Fifteen of them were given antisyphilitic treatment, which produced no effect on the asthma, although the syphilis was improved.

In ten others, antiasthmatic remedies were used, the asthma being improved while the syphilis was not affected. The authors conclude that syphilis is not a factor in the etiology of asthma.

McBride, Iowa City.

A New Method of Gastric Analysis. A. M. Altshuler, Ann. Clin. Med. **5**:464, 1926.

Altshuler investigated the Zimnitzky method for determining the secretory function of the stomach, which is based on repeated physiologic stimulation with beef broth. A test breakfast of 200 cc. of warm beef broth (44 Gm. of lean beef in 1 liter of water) is given. At fifteen minute intervals during the following hour, 10 cc. of the stomach contents is aspirated. At the end of one hour, the stomach is emptied and the procedure is repeated for another hour. Each aspirated sample is tested at once for mucus, bile, free hydrochloric acid, total acidity, lactic acid and occult blood. Altshuler grouped his patients into five types: (1) the normal type, in which the acidity for the second hour is greater than that of the first; (2) the asthenic type, in which the total figures for the first hour exceed those of the second; (3) the inert type, characterized by sluggish response to the first test meal and a marked increase during the second hour; (4) the isosecretory type, in which the gastric secretion is the same during both hours, and (5) the torpid type, in which neither the first nor second test meal excites sufficient stimulation to reveal the presence of free hydrochloric acid. A parallelism was demonstrated between certain pathologic states and the various types. Altshuler feels that this method possesses distinct advantages over the "single extraction method" in that it gives a true conception of the course of gastric function.

Walter M. Simpson.

Experimental Aspiratory Abscess. D. T. Smith, Arch. Surg. **14**:231, 1927

In 20 per cent of the animals used, guinea-pigs, mice, rabbits and dogs, lung abscesses were produced by intratracheal inoculation of material scraped from the alveolar border of teeth of patients with pyorrhea. The same organisms were recovered from the experimental abscesses and from nonoperative and postoperative abscesses in man.

N. Enzer.

Acute Lymphatic Leukemia, Illustrated by Two Cases. George P. Laton, Internat Clin. **4**:185, 1926.

Laton makes the following observations, based on the study of two cases of acute lymphatic leukemia in infants aged 4 months and 9 months when first seen: The onset may be slow and insidious rather than acute. Remissions may occur even after a prolonged febrile period. The higher the lymphocytic count in both numbers and proportions, the less likely is transfusion to have any effect. Leukemic infiltrations of the skin occured in both cases, limited

to the scalp in one and general in the other. This infiltration spared the ordinary lymph glands and apparently attacked the superficial lymph channels and nodes. Edema is to be expected in lax tissues adjacent to infiltrated areas, and is more marked than in the ordinary anemias. In general, there was a marked resemblance to the profound cachectic stage of general carcinomatosis as it occurs in adults.

SMITH, Ogden, Utah.

SOCIAL CONDITIONS AND ACUTE RHEUMATISM: CHILD LIFE INVESTIGATIONS. MEDICAL RESEARCH COUNCIL, Special Report Series no. 114.

Taking London and Glasgow as representative city communities, a committee investigated the problem of rheumatism in children there. Most of the children studied were between the ages of 6 and 10 years. Only true cases, manifested by joint symptoms, heart disease and chorea, either singly or in combination, were considered.

The committee found a somewhat greater percentage of rheumatic persons among the relatives of rheumatic patients than among the control cases. The disease more often attacked several members of one generation rather than being transmitted from parents to offspring; however, there was evidence of an hereditary predisposition to the disease. There was a definitely smaller ratio of healthy throats in the rheumatic than in the nonrheumatic children. Removal of tonsils did not afford an absolute immunity but was unquestionably of benefit in raising the general health condition in most cases. Chorea was the most frequent rheumatic manifestation in cases in which tonsillectomy had previously been done. No definite evidence of one patient infecting another was found, but high incidence of the disease among contacts points to probable infectivity. Rheumatism was less frequent among the well-to-do; otherwise, social conditions were of little consequence. Health of parents, maternal care, and clothing were poorer, and subjection to exposure was greater in the rheumatic families. In one locality, houses situated below 50 feet above sea level had more rheumatic patients than those above, other factors being similar.

In general no one thing, except perhaps the last mentioned, could be designated as a direct causative agent of the disease other than as it lowered the resistance of the patient; however, close contact and hereditary predisposition appeared to be possibly, but only possibly, responsible in some instances.

BARNETT, Chicago.

THE RELATION OF THE HYPOPHYSIS TO DIABETES MELLITUS. A. R. COLWELL, Medicine **6**:1, 1927.

Colwell has reviewed the literature relating to glycosuria in relation to hypophysial disease and trauma in the vicinity of the hypophysis and is of the opinion that there is no definite relation between diabetes and the glycosuria produced by experimental manipulation of the hypophysis or surrounding structures. In some instances of acromegaly, symptoms appear in every way analogous to pancreatic diabetes, even to the extent of death in coma; in other instances, glycosuria is the only sign of disturbed carbohydrate metabolism. The same signs may occur in nonacromegalic disorders of the hypophysis.

"The transient glycosuria which may be induced by various types of hypophysis and central nervous system manipulation, trauma, new growths and other lesions is ordinarily thought to be due to an excessive rate of glycogenolysis which temporarily supplies glucose at a rate which exceeds the normal ability of the organism to dispose of it with the result that increased

blood concentration and glycosuria occur. The hyperglycemia and glycosuria exist as long as the glycogen and the stimulus to glycogenolysis endure. On the other hand the current conception of diabetes mellitus is that it is due to an absolute deficiency of insulin resulting in a subnormal capacity for utilizing glucose."

Though the two types of glycosuria are of different origins, they are closely connected in effect and possibly have the same physiologic significance.

His recapitulation of the evidences is as follows:

"1. Lesions involving the hypophysis or the portion of the brain adjacent to it, whether induced experimentally or occurring during the course of juxta-hypophysial disease, are frequently accompanied by hyperglycemia, glycosuria or diabetes mellitus.

"(*a*) A tumor of the hypophysis practically always exists in acromegaly and diabetic states are significantly frequent in this condition.

"(*b*) Glycosuria and diabetes are by no means uncommon complications of other clinical disorders involving the region of the hypophysis.

"(*c*) Glycosuria may be produced by experimental stimulation or injury of the hypophysis or the base of the brain in the region of the floors of the third and fourth ventricles. Glycosuria produced in this manner has been invariably temporary, i. e., no one has yet succeeded in producing permanent diabetes mellitus by experimental manipulation in the region of the hypophysis. It may be remarked in this connection that neither has any one succeeded in experimentally producing a permanent or progressive lesion in the region of the hypophysis. Whether the presence of the hypophysis is necessary for the production of glycosuria in this manner has not been determined. The most recent investigations indicate that the glycosuria which follows manipulation or stimulation of the hypophysis may be due to unavoidable stimulation or injury of the hypothalamus.

"2. The diabetes mellitus which so frequently accompanies acromegaly resembles ordinary diabetes mellitus in all respects while it exists. It would seem to be justifiable, therefore, to conclude that it is a true diabetes mellitus due to a deficiency of insulin secretion from the islet apparatus in the pancreas.

"3. The diabetes of acromegaly differs from ordinary diabetes without hypophysis disease in that it is capable of undergoing spontaneous, temporary, or permanent recovery. This fact is considered to be highly significant, for if the diabetes of acromegaly is true diabetes and if it is capable of disappearing, then a knowledge of the mechanism in a study of the cause or cure of ordinary diabetes is desirable.

"4. There is little reason to believe that a distinct hypophysial diabetes occurs which is different from diabetes mellitus.

"5. The belief that destruction or removal of the hypophysis results in an abnormally high power to utilize glucose which is the converse of diabetes mellitus is based largely on evidence derived from alimentary determinations of the tolerance for carbohydrates. These determinations are unreliable as they involve variable factors and are known to be subject to wide normal fluctuations. More reliable methods of measuring the functional glucose utilizing ability of the organism suggest that the removal of the hypophysis causes no permanent deviation from the normal.

"6. The subcutaneous or intravenous administration of pituitary extracts is often followed among other things by transient hyperglycemia and glycosuria. A durable diabetic state has not been produced by hypophysis extract administration. The hypoglycemia and shock resulting from insulin administration

in animals are relieved by hypophysis extract. In possessing these physiological properties hypophysis and suprarenal extracts are similar.

"7. Hypophysectomized animals appear to be more sensitive to the action of insulin than normal, but the same sensitivity has been observed after hypothalamic injury in animals with intact hypophyses."

In conclusion, Colwell states: "The rôle of the hypophysis in carbohydrate metabolism is not definable with certainty at the present time. It is probable that it is without significance in this field as a gland of internal secretion, but that important nerve centers or pathways are situated in or near it which are concerned in the control of the metabolism of carbohydrates. It is not impossible that these centers or tracts are involved in the control of insulin secretion."

ROYSTER, University, Va.

DIATHERMY IN THE TREATMENT OF PNEUMONIA. WILLIAM BENHAM SNOW, Northwest Med. **26**:20 (Jan.) 1927.

Diathermy consists of heating the internal tissues by means of the passage of a high frequency current. The tissues are not favorably affected by a temperature below 115 F. Pneumococci succumb to a temperature of 125 F. in ten minutes. Cases in which diathermy is used usually terminate by lysis. Application is made through two warm, moistened electrodes of soft metal, and the current is passed from one lung to the other at a temperature that the skin will tolerate. This relieves pleurisy in the early stages and usually causes early termination. Care must be observed in advanced cases and in cases showing cardiac complication, as the treatment may depress the heart.

Diathermy is always a synergist to other forms of treatment. Favorable clinical results have been obtained in series reported by various authors.

CHRONIC COLITIS. C. E. HAGYARD, Northwest Med. **26**:62 (Feb.) 1927.

Hagyard discusses the pathology, symptoms, diagnosis, roentgenography and treatment of chronic colitis. He believes many cases are due to an infection with a streptococcus altering the motor function and impairing the protective barrier of the mucosa to toxic products.

DISTURBED GLUCOSE METABOLISM OBSERVATIONS, WITH ETIOLOGIC SIGNIFICANCE. C. H. HOFRICHTER, Northwest Med. **26**:146 (March) 1927.

If the normal person is given, on a fasting stomach, a test meal consisting of 1.75 Gm. of glucose per kilogram, there will be a sharp transient rise of blood sugar followed by a sharp fall to normal in three hours. During this rise, no glycosuria occurs. There may be five variations from this normal:

1. Delayed disappearance of the hyperglycemia without glycosuria.
2. High fasting blood sugar not returning to normal in three hours.
3. Delayed return to normal with glycosuria.
4. High fasting blood sugar with glycosuria not returning to normal in three hours.
5. No persistent hyperglycemia but glycosuria present.

Arthritic patients showed a persistence of the test meal hyperglycemia and were improved by correction of the disordered metabolism. Arteriosclerotic patients showed similar blood sugar curves, with the appearance of glycosuria. The glucose metabolism is also altered in carcinoma, in nervous excitment, in acute infections and in the glandular tuberculosis of children.

SCOTT, Philadelphia.

A Case of Hodgkin's Disease in the Inguinal Lymph Glands. G. Castorina, Pediatria **35**:179, 1927.

A boy of 9 presented a sausage-shaped tumor in the left inguinal region. Biopsy proved the case to be one of Hodgkin's disease. The tuberculin test and the blood Wassermann reaction were negative. Cells strongly resembling those described by Sternberg were found in the spleen, some of which were obtained for examination antemortem by puncture. Examination did not disclose glandular enlargements elsewhere. The boy died two months after he had been first seen. Autopsy was not done.

Sala, New York.

Hemophilia and Its Therapy. R. Feissly, Jahrb. f. Kinderh. **110**:297, 1925.

From his experiments Feissly concludes that the failure of coagulation in hemophilia is due to an anomaly in the formation of the serozyme. This anomaly can be explained as follows:

1. The proserozyme is abnormal because the mother substance is difficult to break up.
2. The proserozyme is normal, but a kinetic factor is missing which prevents the normal transformation.
3. The proserozyme is normal but an unknown factor becomes stabilized which is probably also found in normal blood but is increased in hemophilic blood (Howell's hepaim).

Of these three the author thinks the last theory is the most probable.

Ehrmann, Chicago.

Spontaneous Chylothorax in a Child. Egon Fürth, Wien. klin. Wchnschr. **40**:350 (March 17) 1927.

In true chylothorax, the fluid contains emulsified fat. In addition droplets of fat may also be present. No cells or only a few are present. The effusion often forms rapidly. The chyle escapes from the thoracic duct or its collaterals as the result of gross injury, erosion by malignant tumors or chronic infectious processes, rupture of the duct from peripheral obstruction, diapedesis through injured areas in its wall, etc. The effusion is more commonly located on the right side, due to the anatomic position of the thoracic duct. Inanition frequently follows a large loss of chyle but is usually temporary. The chyle can be rapidly resorbed. Death has resulted from pressure in massive chylothorax. Pseudochylous effusions are composed of protein particles and cells. They may result from transudation from the blood, or from degeneration of pus or tumor cells. They contain practically no fat except that in their cellular content.

Fürth reports the case of a girl of 5 who had been ill a month with cough, rattling sounds in the chest and dyspnea. Swelling and edema on the left side of the neck and chest followed. Physical and roentgen-ray examinations disclosed a massive effusion in the left pleural cavity and a large mediastinal tumor. The aspirated fluid was chyle. The Abderhalden test gave a strong reaction for thymus, lymph gland and lung. The uncommon site of the chylothorax on the left was explainable by a lesion in the upper portion of the thoracic duct or in a left collateral. Temporary improvement in symptoms, disappearance of the effusion, and diminution of the mediastinal tumor followed deep roentgen-ray therapy. The symptoms, however, returned and the patient died four months after the onset from generalized metastases. Autopsy confirmed the clinical diagnosis of lymphosarcoma of the mediastinal lymph glands which had infiltrated the chest and metastasized widely. The thoracic duct was buried in the tumor mass. The author reviews the cases previously reported in the literature.

Olmsted, Seattle.

CONTRIBUTION TO THE STUDY OF THE SPLENOMEGALIES OF INFANCY. ARVID WALLGREN, Acta Paediat., supplement, 1927, vol. 6, pp. 120.

This monograph is based on four case reports of splenomegaly in childhood, attributed to obstruction of the splenic vein. The cardinal symptoms of the condition are: hematemesis, great enlargement of the spleen, and a severe anemia of the secondary type. A mild ascites may or may not be present. A most characteristic feature is said to be the great diminution in the size of the spleen associated with the hematemesis. When this has ceased, the organ gradually increases, regaining its former size in the course of a week or two. Splenectomy seems to be of great value. The spleen is found to be firm and congested, with a notable increase in fibrous tissue. Evidences of collateral circulation (esophageal varices, etc.) are present.

Although the author raises many cogent arguments for the presence of obstruction to the splenic vein near its entry into the portal vein as a cause of this condition, such an obstruction was not demonstrated in any of his cases. He has, however, collected from the literature a number of cases in which an obstruction was found. The various facts presented and the theories involved are discussed at great length. The relation between the condition described and Banti's disease is not made clear.

HOLT, Baltimore.

GAUCHER'S DISEASE AND DISEASES RESEMBLING IT. L. PICK, Ergebn. d. inn. Med. u. Kinderh. **29**:520, 1926.

Following a historical summary of Gaucher's disease, Pick tabulates the data on thirty-nine cases proved by examination of autopsy material in twenty-nine cases, and of operative specimens in eighteen. The maximum weight for the spleen in an adult was 8,100 Gm.; the average weight of twenty-four was 2,700 Gm. The material was from twenty-five females and fourteen males; the youngest patient was a girl, aged 8 months. In one third of the cases there was a tendency for the disease to occur in several persons in one generation. The characteristic alteration in the reticulo-endothelial system of the spleen, liver, lymph glands and bone marrow is the deposition in the Gaucher cells of an optically and chemically indifferent Gaucher substance. This, according to Epstein and Lieb, is probably a cerebroside and is the result of some metabolic disturbance. The best stains for demonstrating Gaucher cells are Mallory's phosphomolybdic acid, aniline blue and orange G. method; Weigert's iron-hematoxylin, and the Bielschowsky-Maresch stain.

Lipoid cell hyperplasia in the spleen of diabetic patients dying in coma with a high lipemia is easily differentiated from Gaucher's disease by the demonstration of neutral fats and cholesterin esters in the cells. The lipoid cell splenohepatomegaly of Niemann can be recognized by its rapid course, phosphatid content of the blood and alterations in the thymic body and suprarenal glands.

GEORGE RUKSTINAT.

OSTEODYSTROPHIA FIBROSA [OSTEITIS FIBROSA]. E. CHRISTELLER, Verhandl. d. Deutsch. path. Gesellsch. **21**:7, 1926.

In autopsies on patients with bone diseases the skeleton as a whole, habitus, proportions and single bones, should be studied; photographs and roentgeno-

grams should be made of the skeleton or the most important bones; the whole skeleton, or at least the skull, ribs, vertebrae, pelvis and a few long bones should be examined carefully; material for maceration and moist conservation should be selected; the glands of internal secretion and organs with metastatic calcifications should receive special attention. Changes typical of osteitis fibrosa are the extensive resorption and simultaneous excessive new formation of bone tissue and the transformation of the bone marrow into fibrous tissue, while in the malacic diseases the insufficient calcification of osteoid tissue is the main change, and fibrosis of the marrow is found only after trauma. Osteitis fibrosa starts with an increase in the activity of the osteoblasts. This process is followed by a proliferation of the bone marrow and apposition of new bone by the endosteum. If these processes are well balanced change does not occur in the macroscopic appearance of the bone. A predominance of the osteoclastic activity will result in a rarefaction of the bony substance, while an osteoblastic increase will produce a thickening. The newly formed bone in early and progressive cases is porous, but changes later, especially in cases with a slow course, into a bone of a ivory-like character, representing the end-result of the disease. Deformities of the bones are most frequently found in the porotic type (kyphoscoliosis, elongation, thickening and curvatures of the long bones, elevation of the base of the skull, etc.). Fractures are often numerous. All these deformities are fixed by the subsequent sclerosis. Another factor of influence on the symptoms of the disease is the age of the patient. Osteitis fibrosa in childhood causes disturbances of the epiphyseal growth resulting in thickening of the joint regions, production of rosary, defects in the calcification zone, etc. On account of these pseudorachitic symptoms, an infantile type is distinguished from the common adult type and the sclerotic senile type. Osteitis deformans, or Paget's disease, ranks in this classification as an adult hyperostotic-porotic type and is not regarded as a disease *sui generis*. The giant cell sarcoma of bone in osteitis fibrosa is interpreted as a benign, cellular proliferation with resorptive functions and is not specific, being also found in Koehler's disease (tarsal scaphoiditis), hematoma of bone, pseudoarthrosis, delayed fracture and other conditions. The benign character is shown by multiplicity, circumscribed growth, which is arrested at the periosteum, location at places on which a special strain is exerted, the regularity and maturity of cells and the cluster-like arrangement of the giant cells. Metastases from these tumors as such are never observed. The solitary myelogenous giant cell sarcomas and epulides are considered as belonging to this group of tumors and representing probably a special type of localized osteitis fibrosa. Hyperostotic formations appear often symmetrically in the tibia or on the skull, where they produce a picture known as "leontiasis ossea." Similar changes may be due to rickets, syphilis, metastatic carcinosis of the bone and primary bone tumors. Leontiasis ossea is therefore only a symptom and not a disease. Osteitis fibrosa is a disease that affects in general the whole system. Reports of localized forms are mostly due to incomplete examination of the skeleton. The clavicles and the long bones are especially involved in this type. The development of malignant tumors from giant cell sarcomas is reported in several cases and the giant cell sarcomas are regarded as presarcomatous formations. The cystic formations in the bone, regarded as due to liquefaction of the tissue of the giant cell tumors, represent their final stage; according to some, they may result from small hemorrhages into the marrow which continue and progress for some time due to the hydrostatic pressure and venous congestion, ending in a cyst. Differentiation from syphilis of the bone rests on the porous character of the bone, the wide marrow cavity and the normal periosteum in osteitis fibrosa, and the ivory-like bone, the nar-

row marrow cavity, the periosteal osteophytes in syphilis. The classification of "fragilitas ossium" (Albers-Schönberg) is difficult and has to remain undecided. Rickets and osteomalacia do not represent a basis for a secondary osteitis fibrosa. But mixed forms were observed. Changes in bone from starvation show alterations which are sometimes similar to those seen in hypostotic-porotic osteitis fibrosa, while others resemble more those of osteomalacia. Moeller-Barlow's disease, trophic osteoporosis and senile osteoporosis differ from osteitis fibrosa by their lack of increased resorption of bone substance. The osteoporosis in Recklinghausen's disease cannot be classified. Observations on disturbances in the calcium metabolism are insufficient to allow definite conclusions. In cystic osteotis fibrosa a retention of calcium was observed. A diet deficient in calcium in a case of hyperostotic-porotic osteitis fibrosa produced a higher blood calcium level and a negative calcium metabolism; the condition changed after a diet rich in calcium only by increasing the blood calcium. The hypostotic type in monkeys has an increased calcium elimination, while the hyperostotic type shows a calcium retention. Hyperplastic proliferations of the parathyroid glands are frequent in osteitis fibrosa, but their significance is doubtful and may be compensatory. Osteitis fibrosa has been observed also in animals (swine, gazelles, goat, opossum, cattle, horse, dog, porcupine and monkey). The horses have mostly a condition of the jaw representing a hyperostotic-porotic type. The old world monkeys show only the hyperostotic type, while the new world monkeys show exclusively a hypostotic type. The gundu of the African monkeys is an osteitis fibrosa of the nose.

THE CLINICAL ASPECTS OF OSTEODYSTROPHY FIBROSA [OSTEOITIS FIBROSA]. P. FRANGENHEIM, Verhandl. d. deutsch. path. Gesellsch. **21**:49, 1926.

Frangenheim recognizes, besides the juvenile, adult and senile types mentioned by Christeller, a congenital form. This is the cause of intra-uterine fractures of the tibia (congenital pseudarthrosis). Its prognosis is unfavorable. Early radical operation in a few cases was successful; usually amputation of the leg is necessary. A disturbance of the embryonic anlage of the bone is regarded as a more important etiologic factor than trauma. Of the juvenile and adult types, circumscribed osteitis fibrosa of the skull starts in early childhood and produces the first pronounced symptoms in the second or third decennium; the temporal region is mostly affected; there is progressive headache, paresis of brain nerves and exophthalmus, and the roentgen-ray examination shows thickening of the bone with indistinct outlines and unequal density of the shadows in places; after resection of bone and secondary autotransplantation, recurrences are rare. Leontiasis ossea involves mainly the facial part of the skull and results from progressive mild infection from sinuses (Knagg), ending in osteitis fibrosa. Gundu starts as a juvenile hyperostotic-porotic type which changes later into an adult hyperostotic-sclerotic type. Generalized osteitis fibrosa occurs especially in females in the fifth and sixth decenniums. Infectious diseases and nutritive, metabolic and endocrine disturbances play a part in the causation. Parathyroid enlargements are often but not regularly present. The blood shows secondary anemia due to fibrosis of the marrow. The course either ends in death after a few years, with marked malacia of the bones, or continues over many years. Pregnancy should be avoided. Resection, with autotransplantation and crushing of the cysts to remove the tension and to relieve the patient from pains, may be attempted. Oöphorectomy is without success, also transplantation of parathyroid glands. After removal of parathyroid glands improvement has been observed. Roentgen-ray treatment arrests the osteoclastic processes and produces fibrosis. Circumscribed solitary cysts are

frequent and may be found in almost every bone, especially in the shafts of young persons. The epiphyses are rarely involved. The wall is thin and friable, and the cavity filled with serous or serohemorrhagic fluid. There may be one or more compartments and no cellular lining. The cause may be trauma with damage to the endarteries of the epiphyseal line, followed by necrosis of the corresponding bone, and resorption by osteoclasts, infectious diseases (scarlatina, appendicitis, angina), congenital syphilis (perhaps indirectly through its effect on the endocrine system), rickets, osteomalacia, malnutrition, circulatory and blood disturbances, anemia, local disposition and other conditions. After spontaneous or surgical fracture of the cyst or curettement of the cystic wall, the cavity is filled by a sclerotic fibrous tissue which is later transformed into bone tissue. Of the senile type (Paget's disease, osteitis deformans), more than 350 cases have been reported. It may occur in families. Sclerosis of the spinal cord and intestinal intoxication by acid producing bacteria are considered as causative factors besides those mentioned. A lymphocytosis and monocytosis, retention of calcium, magnesium and phosphorus and decrease of the sulphur of the blood are observed. Many bones are affected, especially long bones of the lower extremities, clavicle and skull. Neuralgic or rheumatic pains are felt in the affected parts and increased temperature and redness of the skin over the diseased areas. The course is slow without interference with the general health. The disease starts usually after forty and may last many years. The attitude of the patients resembles that of the anthropoid apes (the spine is kyphotic, the arms hang low down, the head is stretched forward, the chin is raised, the face is thin and the legs are bent in the knees). The skull is enlarged and the forehead appears to be high on account of baldness. The occipital foramen is narrowed. The disease appears to be rare in this country, while the localized type, involving usually the tibia, is frequent in Germany. The administration of ovarian preparations and removal of sexual glands has not had any effect. Improvements were seen in some patients treated with compounds of arsenic, mercury, iodine, calcium and phosphorus; also after epinephrine, thyroid substance, tuberculin and quinine. Removal of the parathyroid glands and roentgen-ray radiation were successfully tried. Surgical operations are contraindicated on account of frequent subsequent pseudarthroses.

OSTEITIS FIBROSA. G. SCHMORL, Verhandl. d. deutsch. path. Gesellsch. **21**:71, 1926.

Schmorl found twenty-five cases of osteitis fibrosa among 32,000 autopsies before October, 1925. Since then he saw eighteen more cases among 650 autopsies (2.75 per cent against 0.062 per cent in the previous period) after starting routine examination of the skeleton. The macroscopic diagnosis was possible after some experience, but microscopic examination was made in all cases. Skull, sternum, ribs, femur, vertebrae, pelvis and diseased bones were regularly examined. The vertebrae were most frequently involved, showing porous densities underneath the vertebral disks, in the other bones those alterations were usually present in the subchondral regions. In the differential diagnosis, the presence of a mosaic structure of the newly formed trabecula in osteitis fibrosa is emphasized. This mosaic structure is due to resorptive and oppositive processes in small areas of the bone and is especially seen in the hyperostotic type, but never in any other disease of the bones accompanied by regenerative processes (callus, rickets, osteomalacia, bone tumors, hyperostoses, syphilis and fragilitas). The progressive atrophy of bone is regarded as a special type of osteitis fibrosa on account of the giant cell sarcomas observed, the excessive

resorptive and appositive processes and tumors of the parathyroid glands. Hunger osteopathy is sometimes similar in structure to osteitis fibrosa but is interpreted as an osteomalacic process. Degeneration of articular cartilage and cartilagenous proliferations on synchondroses were observed in osteitis fibrosa. Cases were seen with remissions or spontaneously healed foci in some of the bones and active processes in others.

SCLEROSIS OF THE PULMONARY ARTERY IN AN INFANT, WITH TRANSPOSITION OF LARGE VESSELS. WATJEN, Verhandl. d. deutsch. path. Gesellsch. **21**:259, 1926.

A case of isolated sclerosis of the pulmonary artery in an infant, aged 6 months, is reported. A transposition of the large vessels, a large defect in the auricular and ventricular septum and an open foramen ovale were seen. The stem of the pulmonary artery and the intrapulmonal and extrapulmonal branches were aneurismally dilated. The wall of the larger and median sized branches was markedly hypertrophic and the intima was thickened. These changes were still more marked in the small and smallest branches, where also deposits of lipoids were present. The functional-mechanical strain to which the wall of the pulmonary artery was exposed continuously, getting its blood from the left ventricle, was regarded as the cause of the pathologic changes. Their rapid development was remarkable. The Wassermann reaction was negative.

W. HUEPER.

Nervous Diseases

THE USE OF TRYPARSAMIDE IN NEUROSYPHILIS. SIDNEY I. SCHWAB and LEE D. CADY, Am. J. Syph. **1**:1 (Jan.) 1927.

Increased familiarity with the use of the drug has done away with the danger of serious eye complications. The change in method is mainly: (1) decrease in the initial dosage; (2) gradual increase in the amount of the drug, and (3) longer intervals between treatments. With these precautions, any patient whose optic nerve and its mechanism are intact may be treated with safety, and in those patients having mild neuritis to atrophy, tryparsamide may be used with the same degree of danger as any arsenical.

Private patients with good hygienic surroundings improve more rapidly than those with poor surroundings. Fifteen of 230 patients have been discharged as possibly cured. Fifteen more are ready for discharge. From one to nine courses consisting of from six to ten injections at from seven to fourteen day intervals were given. Various arsenicals, mercury and bismuth have been used concurrently. In the early cases, some eye damage was experienced. None has occurred during the last twelve months. Improvement is shown in 80 per cent of the cases of meningovascular syphilis, 56 per cent of the cases of tabes, and in 68 per cent of the cases of general paralysis.

The authors point out that a higher percentage of improvement is attained without the loss from death that attends the malarial treatment of this condition. A short résumé of the malarial treatment is cerebrospinal syphilis is given.

OBSERVATIONS ON THE USE OF PLASMODIUM VIVAX IN THE TREATMENT OF CEREBROSPINAL SYPHILIS. J. H. ST. JOHN, Am. J. Syph. **1**:14 (Jan.) 1927.

The author reports the treatment of three patients with general paralysis, whose conditions after a year of observation had neither progressed nor deteriorated. He found that the mosquito *anopheles punctipennis* was of value

in experimentally reproducing malaria. He sounds a warning against the practice of discharging patients immediately after their antimalarial treatment had been given, since in a certain number relapses occur. Other patients develop the carrier state and become a menace to the community.

THE RACIAL PROSPECT OF GENERAL PARALYSIS. LEO KANNER, Am. J. Syph. **1**:23 (Jan.) 1927.

The author reviews the history of general paralysis and of syphilis in the various races.

He concludes that general paralysis makes its appearance from 200 to 300 years after the infection of a nation with syphilis, and that the prevalence gradually increases for about 200 years. It then begins to decline and may ultimately become extinct.

THE SUGAR AND CHLORIDE CONTENT OF THE CEREBROSPINAL FLUID WITH SPECIAL REFERENCE TO NEUROSYPHILIS. S. WILLIAM BECKER, Am. J. Syph. **1**:37 (Jan.) 1927.

The author concludes that the chloride and sugar of the cerebrospinal fluid is not sufficiently altered from the normal to make it of great value from the standpoint of diagnosis or prognosis.

McBRIDE, Iowa City.

A CLINICAL STUDY OF EPILEPTIC CHILDREN TREATED BY KETOGENIC DIET. FRITZ B. TALBOT, KENNETH M. METCALF and MARGARET E. MORIARITY, Boston M. & S. J. **196**:89 (Jan. 20) 1927.

A previous report gave the results of chemical investigations of the rational treatment of epilepsy by the ketogenic diet. This report deals first with a discussion of the ketogenic diet used in the Children's Department of the Massachusetts General Hospital and its fulfilment of the needs of the child; and second, with the beneficial results to the epileptic child by the dietary treatment. Charts are given illustrating the basal requirements of boys and girls of various weights; nitrogen balance with the ketogenic diet; calculation of the diet; attacks in relation to diet ratios and blood chemistry; attacks and blood changes with fast; attacks and blood changes with ketogenic diet, and a summary of case records of twelve patients on ketogenic diet.

In calculating the diet, the patients are ordinarily started on a ratio (R) of one and a half times the grams of fat (F) to one of the combined grams of carbohydrate (C) and protein (P), or $F = 1.5\ (C + P)$. It is usually necessary to increase this ratio up to 3 to 1, and sometimes 4 to 1 before the beneficial effects of the treatment are satisfactory. The protein requirement is estimated on the basis of 1 gram per kilogram of expected body weight. When nine calories are allowed for each gram of fat, and 4 calories for each gram of carbohydrate and protein, the total caloric requirements of the patient are equal to $9F + 4C + 4P$; or when the formula is substituted for F, the ketogenic diet is calculated by the simple formula total caloric requirements $= 9 \times [R\ (C + P)] + 4C + 4P$.

As the total requirements are known as well as the ratio (R) and the number of grams of protein (P), a value for C (grams of carbohydrate) is easily found by the formula given, and then a value for F by the formula $F = R\ (C + P)$.

The authors found (1) that the ketogenic diet fulfils the needs of the child, if the necessary factors of total calories and protein, vitamin and salt requirements are taken care of in the diet; (2) that a marked ketosis may be main-

tained over a long period of time without any unfavorable symptoms; (3) that the improvement of the epileptic condition and the blood chemical changes in children produced by a ketogenic diet are similar to those produced by fast, and (4) that a diet sufficiently ketogenic to produce a marked ketonuria usually results in a definite improvement of epileptic symptoms. GEGENBACH.

SOME NEUROTIC DISORDERS IN EARLY LIFE. J. P. CROZER GRIFFITH, Philadelphia, M. J. & Record **125**:149 (Feb. 2) 1927.

For convenience of study one may divide these disorders into simple nervousness, psychasthenia and hysteria, but with the understanding that the boundary lines separating these conditions are vague. The nervous child often becomes most nervous when the general health is poorest.

Nervousness.—Inheritance is a prominent etiologic factor, and the child is born with a neurotic diathesis, as some have called it. Under good general conditions and training, symptoms may never appear, but the tendency is there. In every child there is a vivid power of imagination, rapid growth of intellectual faculties and a strong tendency to imitation. With harmful associations, the neurotic child is bound to develop symptoms, and even one with an originally normal nervous system is likely to do so. Often the hours of study and play are too long for the child with its brain and mental powers in a formative state. General symptoms shown by children of this class are briefly considered by the author. Ready vomiting is a nervous phenomenon in a great number of cases. To this class belong the infants who cannot sleep in a room without a light or who at an early age manifest an undue fear of strangers. As childhood comes on one notices the characteristic physical development, the delicate build, the tendency to anemia, indigestion, capricious appetite and the ready mental and physical fatigue. These children are of a distinctly excitable and emotional type. The element of fear is often marked. They readily acquire nervous habits, such as lisping, stammering and thumb-sucking. The author reports three interesting cases.

Psychasthenia.—Under this heading are included cases closely allied on the one hand to simple nervousness and on the other to insanity of a temporary nature. The condition is inborn. Among the numerous symptoms, the elements of doubt and fear are specially marked. The author then gives a few short histories of such cases.

Hysteria.—The author then discusses hysteria, its etiology, symptoms and diagnosis. Cases are also discussed. The treatment of patients with these various nervous conditions is a matter of great interest and importance and often one of great difficulty. Overexcitement must be avoided; play restricted. Attention must be given to the general health. Separation from the nervous parent is important. In the severer cases, such as the psychasthenic and the hysterical, the object of the treatment is to make the child forget. Tonics are often needed and in some cases sedatives are useful, but the chief thing is management. Great care must be taken to avoid relapse, remembering that the underlying neurotic disposition is never cured.

WILLIAMSON, New Orleans.

STAPHYLOCOCCUS MENINGITIS. A. CASTELLO, Pract. pediat. **3**:192 (Nov.-Dec.) 1926.

The author presents a case of staphylococcus septicemia in a child, aged 11 years. The course of the disease was characterized by two distinct periods.

The first period was of twenty-one days' duration. There were signs of a severe septicemic infection with symptoms referable to the intestinal tract. After a few days, multiple small abscesses developed in the orbital region, involving the lacrimal gland, and a similar collection of pus occurred on the forearm. Following incision and drainage, the patient made what was apparently an uneventful recovery. One month later an osteomyelitis of the maxilla developed, followed by a septicemic staphylococcic meningitis. The patient died. *Staphylococcus aureus* was recovered from the spinal fluid.

ZAMBARANO, Northville, Mich.

SEASONAL VARIATIONS IN THE FACIAL PHENOMENON IN CHILDREN. INTERPRETATION AND SIGNIFICANCE OF THE SIGN IN RELATION TO SPASMOPHILIC DIATHESIS. EUGENIA DE MICHELI, Riv. di. clin. pediat. **25**:97, 1927.

The frequency of the occurrence of Chvostek's sign during various months of the school year was observed in 2,008 school children from the city of Milan and in 590 from a suburb of that city. The table shows the percentage of children with a positive Chvostek sign.

Children with Positive Chvostek Sign

	Oct. Per Cent	Dec. Per Cent	Jan. Per Cent	Feb. Per Cent	March Per Cent	April Per Cent	May Per Cent	June Per Cent
Milan	10	25	32	31	33	32	31	16
Suburb ...	8	17	30	35	35	18	15	11

The Chvostek sign was found more frequently in the city than in the suburbs, more frequently in winter and spring than in summer and autumn, and especially among the physically and mentally retarded children of the poorer classes. Infectious diseases frequently led to a positive Chvostek sign.

The author believes that lessened sunlight in the winter months, with associated toxic and dystrophic factors, is important in explaining the results.

HIGGINS, Cincinnati.

CHEMICAL RESEARCHES ON THE SPINAL FLUID. H. BEHRENDT and O. HELM, Ztschr. f. Kinderh. **42**:255 (Nov.) 1926.

The sugar in the spinal fluid in a number of patients with encephalomeningismus was increased in value. In both the purulent and tuberculous forms of meningitis subnormal values in sugar content were observed. The inorganic phosphate in nonmeningitic patients was from 1.15 to 2.9 mg. per hundred cubic centimeters; in meningitic cases, from 2.65 to 5.06 mg. per cubic centimeter. Marked increase in lactic acid occurred in the spinal fluid of a case of Little's disease, in one of septic pyelitis and in one of the convulsive forms of uremia. Normal values could not be accurately established; in cases without convulsions and without meningitis, there was from 2.7 to 5.1 mg. of lactic acid per hundred cubic centimeters.

INFANTILE DYSTROPHIA MUSCULORUM PROGRESSIVA COMBINED WITH DYSTROPHIA ADIPOSO-GENITALIS. LOTTE LANDÉ, Ztschr. f. Kinderh. **42**:355 (Nov.) 1926.

The patient in this case obviously behaved as one with a form of dystrophia musculorum progressiva in the first years of life, and the condition quickly progressed. True hypertrophy of the calf muscles with pes equinus and some-

times clonus did not necessarily speak against this diagnosis. It was observed by Oppenheim and others in unquestionable cases of dystrophy of the muscles; in addition, disturbance of growth and development in the skeleton is a relatively frequent occurrence in myopathy. Such disturbances were described, especially by French authors, as osteomyopathy; recently Sterling has described these disturbances with special care; endocrine influences being looked on as the cause. To these changes in the muscle and the bone symptoms definite symptoms of dystrophia adiposogenitalia were added when the child was 9 or 10 years old. Typical fat deposition — which increased in the hospital in spite of an extremely limited diet and the use of thyroid extract — astonishing smallness of the external genitals, the anomalies of sugar metabolism and the positive observations in the sella turcica established the diagnosis. The increasing mental disturbance and the emotional indifference were likewise to be ascribed to these two complications. They were frequently observed in Fröhlich's syndrome, especially by Biedl, and were emphasized as concomitant symptoms in his cerebral form of dystrophia adiposogenitalia. Frankl'Hockwart spoke of a hypophysial complex, with euphoria, indifference and drowsiness.

THE ETIOLOGY OF MONGOLISM. HERBERT OREL, Ztschr. f. Kinderh. **42**:440 (Nov.) 1926.

Nineteen cases of familial mongolism are compiled from the literature and thirty-two observations of mongolism in twins — thirty-four inclusive of the author's own. In twins of the same sex, either one or both were abnormal; in twins of different sexes, only one was abnormal. One case of mongolism occurred in twins of different sexes in a family in which there was hereditary curving of the little finger and double thumb. Mongolism was further observed in one of twins of different sexes in whose family cleft palate occurred once and cataract twice. On the basis of the twins observed up to the present, and of the cases of malformations found in families with mongolism, mongolian idiocy is looked on as the summation of malformations which are conditioned by heredity and which come together at some time or other in one individual.

EMERSON, Boston.

Diseases of the Eye

HEREDITARY EYE-DEFECTS IN RABBITS, EXPERIMENTALLY INDUCED. FREDERIC ALLISON DAVIS, Tr. Ophth. Soc. **45**:555, 1926.

This paper consists of a discussion of heriditary eye defects in rabbits, experimentally induced. The material on which the study is based was produced by Guyer and Smith of the Department of Zoology of the University of Wisconsin. The lesions were produced by the injection of lens sensitized serums and pulped lens into pregnant rabbits. The study embraces 152 eyes, of which seventy-five were defective.

The outstanding defects found were as follows: Typical coloboma of the iris, ciliary body, choroid, retina and, at times, optic disk, which was accompanied by varying grades of microphthalmos, with and without cystic staphyloma. The coloboma develops as a result of faulty closure of the fetal ocular cleft. The degree of deformity depends on the extent to which the fetal cleft remains open. The cleft is apparently prevented from closing by the persistence and overgrowth of mesodermal tissue in the cleft. This may extend the entire length of the cleft from the optic disk to the corneoscleral margin, or it may be confined to the posterior end of the cleft or to the anterior end.

The lens is affected in varying degrees in most of the eyes. It has apparently remained normal, however, in one eighteen-day embryo, and in one adult eye in which the coloboma was confined to the extreme posterior end of the cleft. In those eyes showing moderate grades of microphthalmos, the lens is well developed, somewhat enlarged and usually spherical. The latter condition is apparently brought about by the swelling of the fibers as the result of relaxation of the zonule in the colobomatous area. The lens substance is completely absorbed only in those cases of extreme microphthalmos with degeneration of the entire eye. Coloboma of the iris apparently involves all the coats of the iris, and coloboma of it, as well as of the ciliary body and of the choroid, is apparently due to failure of the union of the margins of the optic vesicle in the region of the fetal ocular cleft. The absence of the pigment epithelium apparently affects the development of the underlying structures, namely, the stroma of the iris and the choroid.

The theories as to the cause of the persistence and overgrowth of mesoderm in the cleft are discussed. It is assumed that it is brought about by stimulation or overgrowth of mesodermal elements in the cleft, or that it is due to an arrest of development in the advancing optic vesicle brought about through the specific action of an ectodermal antigen, namely, the lens. The latter theory might be further substantiated by the thinned out appearance of the nervous layer of the retina at the margins of the cup. This might represent an abiothrophy of this structure brought about by a specific immunologic reaction. With the acceptance of the latter view, overgrowth of the mesoderm might be regarded as a process of repair in an effort to close the open fetal cleft.

Defective specimens were presented showing the anomaly at various stages. The ages of the animals from which defective eyes were exhibited included embryos of 18 days up to the fully developed animal of 4 or 5 years. A large number of specimens were shown of the new-born rabbit.

F. A. DAVIS.

Diseases of the Ear, Nose and Throat

DISEASE OF THE TONSILS IN CHILDREN. FRANZ HAMBURGER, Wien. klin. Wchnschr. **40**:481 (April 14) 1927.

Hamburger gives an excellent differential diagnosis of inflammatory diseases in the region of the palatine and pharyngeal tonsils. He describes an angina of the latter, which must be distinguished from chronic hypertrophy of adenoid tissue. In such cases, the lymph glands beneath and posterior to the sternomastoid muscle become enlarged and tender. This valuable aid to diagnosis is frequently overlooked.

Although he admits the importance of diphtheria cultures from the point of view of public health, the author is of the opinion that overemphasis has been placed on laboratory, as compared with clinical, diagnosis of diphtheria. The diphtheria bacillus is frequently found in patients suffering from other anginas. Conversely, antitoxin is too often withheld when needed, because the culture is negative.

Painting the inflamed throat with antiseptic solutions is unsatisfactory in children in most cases. For the swollen, tender neck, Hamburger prefers warm oil compresses, because they do not cool as quickly as water poultices. He gives sodium salicylate for a week following angina as a prophylactic measure.

OLMSTED, Seattle.

Surgery and Orthopedics

SOLID TUMORS OF THE URACHUS. L. BRADY, Arch. Surg. **14**:46, 1927.

Including the author's case, twenty solid tumors of the urachus have been reported. His was a fibromyoma weighing 600 Gm. These tumors occurred more frequently in men than in women. Eighteen of the cases were malignant, seven being sarcomas and eleven carcinomas.

N. ENZER.

ON THE TREATMENT OF CONGENITAL CLEFT PALATE. H. BAGGER, Acta otolaryng. **10**:361, 1927.

The author, the chief of the Jutland Clinic for Cleft Palate, goes into a discussion of the history of surgical and prothetic treatment of cleft palate. He summarizes the results in various operative procedures as reported by different authors. At the Jutland Clinic a method of treatment is used which was elaborated by Prof. Ernest Warming, and which consists in speech training. This is combined with the use of a prothesis which has been designed at the clinic. He reports good results in this combined treatment, and prefers it to operation, except for infants.

ANDERSON, Duluth, Minn.

Miscellaneous

THE DEVELOPMENTALLY UNFIT INFANT. G. VAN AMBER BROWN, Am. J. Obst. & Gynec. **13**:341 (April) 1927.

The ideal way to treat the developmentally unfit child is to start several generations before he is born and prevent his arrival. This can be done by persuasion and education; the legislative and compulsive factors are secondary. The author feels that it would be possible to make a new human race in a hundred years if people in positions of influence would wake up to the paramount importance of eugenics.

The eugenic improvement of the race can be secured by establishing State Eugenic Boards the members of which will supervise education of all people in the inheritability of traits and more intelligent ideals of marriage and who will foster movements for segregation of defective persons, marriage laws consonant with the principles of eugenics; selective immigration laws; abolition of war and sound conversion of the birth control movement to act among the unfit.

ALLEN, Chicago.

PSEUDO-HERMAPHRODITISM. PHILIP TURNER, Proc. Roy. Soc. Med. **20**:191 (Jan.) 1927.

Dr. Turner reported a case of pseudohermaphroditism in a patient, aged 15 months.

Society Transactions

AMERICAN PEDIATRIC SOCIETY

Thirty-Ninth Annual Meeting, May 12, 13 and 14, 1927

Continued from p. 153

Third Session, Friday, May 13

The session was called to order at 2:30 p. m.

DIENTAMOEBA FRAGILIS. DR. JOHN C. GITTINGS and ARTHUR D. WALTZ (by invitation).

Dientamoeba fragilis, an intestinal parasite, was first described by Jepps and Dobell in 1918 (Parasitology **10**:352, 1918). Reports of about thirty-seven cases chiefly in adults, have appeared since then.

Its occurrence in three children accompanied by a persistent eosinophilia is reported. All of the children were asthenic and malnourished. Two of them are known to have improved with a diminution in the number of parasites, following treatment, but it is entirely problematical whether there was any connection between this infestation and the symptomatology. It seems possible that it may be one cause for malnutrition and asthenia. The occurrence of eosinophilia, not otherwise explained, should suggest an examination of the stools. The specimens must be as fresh as possible, as the organism will degenerate so as to become unrecognizable in from one to two hours after the stool is passed.

The treatment given was emetin-bismuth-iodide from 0.06 to 0.2 Gm. in keratin coated capsules by mouth, three times a day for three days, followed by a daily enema of from 200 to 300 cc. of a 1½ to 3 per cent solution of Yatren 105 for six days. This injection was preceded by a cleansing enema. Treatment appeared to be effectual in getting rid of many of the parasites, but it is extremely difficult to secure complete elimination. Until more is known of the possible pathogenicity of *Dientamoeba,* persistence in an unpleasant course of treatment did not seem warranted.

DISCUSSION

DR. HEIMAN: Will Dr. Gittings be good enough to tell us the amount of eosinophils found in some of the intestinal conditions; also whether the children came from Philadelphia or from tropical countries?

DR. CLAUSEN: Should the stools be examined warm or not?

DR. HAND: I should like to know the percentage of eosinophilia.

The eosinophilia varied from 6 to 18 per cent. Two of the patients lived in Philadelphia and one in Scranton, Pa. None, so far as I know, was ever in the tropics.

The stools should be examined while still warm. Failure to observe this precaution would probably result in the organism being missed. When they degenerate, the increasing vacuolization leaves only a ring of protoplasm, which makes distinction from *Blastocystis hominis* difficult.

THE WATER REQUIREMENT IN RENAL FUNCTION. DR. J. L. GAMBLE, DR. M. C. PUTNAM (by invitation) and DR. C. F. MCKHANN (by invitation).

The authors report results of experiments with rats undertaken with the purpose of learning in approximate terms the water requirement for excretion in urine of individual substances. Those studied were urea and four salts — sodium chloride, potassium chloride, sodium bicarbonate and potassium acid carbonate. The experimental plan consisted in placing nearly grown rats on diets containing successive increments of the substance to be studied. From measurements of food eaten and water drunk, the concentration of the added substance referred to the water intake was computed. This value was regarded as determined by and closely measuring the concentration optimal for the salt or urea in urine.

The concentration of (Na) + (Cl) ingested in terms of the water intake was found to be closely stationary at 0.65 molar and that for urea at 1.02 molar. Other salts, potassium chloride, sodium bicarbonate and potassium bicarbonate, gave nearly the same value as sodium chloride, and this was also found for mixtures of the salts. For mixtures of salt and urea, however, the sum of the concentrations was the same as for urea alone.

The minimal water requirement for removal of sodium, potassium, chlorine, or carbonous acid in urine is the same for each, and the requirement is additive for mixtures of these ions. The minimal requirement for urea is less than for the salts. But when urea and salts are present for excretion together, the water requirement is the same as for an equivalent quantity of urea alone, unless the partial concentration of salt exceeds 0.65 molar.

DISCUSSION

DR. BLACKFAN: I am hesitant about asking Dr. Gamble a question after having seen the beautiful performance of his rats, but I have had the impression — and I think it is generally shared in the literature and textbooks — that the high threshold concentration substances cannot be concentrated to the same extent as low threshold substances. Yet, if I am correct, in his studies he inferred that the maximum concentration is the same in both substances, and I am wondering if he can offer an explanation as to the difference in the points of view.

DR. GAMBLE (closing): In regard to Dr. Blackfan's question, I think it is commonly stated in textbooks that the high threshold substances such as sodium and chloride in the blood plasma cannot be concentrated to the same extent as the low threshold substances, such as potassium, to mention one that we have studied. What we found here was that so far as absolute maximum concentration is concerned, both can be concentrated in the urine to the same level, but if we refer to the differing values found in the blood plasma we may of course say that the kidney concentrates potassium more than sodium. This way of stating the concentrating ability of the kidney does not, so far as I can see, throw any light on the mechanism of threshold, and is objectionable since it obscures the fact that the maximal possible concentration of the dissociable salts is the same for each.

FACTORS INFLUENCING THE ABSORPTION OF CALCIUM IN INFANTS. DR. BENGT HAMILTON.

The calcium absorption of a premature infant on breast milk was studied in several periods. It was found that the calcium absorption was dependent on the calcium intake, an increase of which increased the absorption, and the

intake of total fixed base (Na + K + Ca + Mg, by Fisk's method), an increase of which was unfavorable to the absorption of calcium. By adding hydrochloric acid to the breast milk an increase of the calcium absorption was obtained, and it could thus be demonstrated that the part of the base that influenced calcium absorption was the part not bound as chlorides. Most of this part of the base is bound to weak acids and consequently is capable of influencing the reaction in the intestine toward the alkaline side.

The acid-base balance of the food influences the absorption of calcium. An acid food is favorable to calcium absorption.

THE ICTERUS INDEX IN CHILDREN. DR. ROOD TAYLOR.

Davis' method for determination of the icterus index with capillary blood makes available a practical method for determining the quantity of bilirubin in the blood of infants and small children.

In the present study, hemolysis was found to be the greatest source of error. It could usually be prevented by allowing the blood to clot and the serum to separate in the cold. Specimens showing even the slightest trace of hemolysis cannot be read and must be discarded.

The results of this work would indicate that the normal index in the infant and child is lower than in the adult. It is never more than 5, and usually ranges from 2 to 4. This low index probably results from the relatively low hemoglobin content of the blood in childhood.

It was found that latent jaundice complicates an uncertain proportion of the indigestions of infancy due to parenteral infections, but is not exclusively confined to those indigestions with pale stools.

In lobar pneumonia the index is often raised, but a low index does not necessarily insure a good prognosis.

The icterus index serves to differentiate hemolytic anemias from secondary anemias. Determination of the icterus index will also make the diagnosis as between appendicitis and disease of the biliary tract, and will serve as the best method of determining whether a manifest jaundice is increasing or diminishing.

In infants under 2 weeks, whether or not manifestly jaundiced, the index was never below 20. In premature infants, the index remained high for one or two months or even longer. Parallel red blood cells, determinations of the hemoglobin content and the icterus index were done, but not in sufficient number to answer the question as to whether there is an increased blood destruction which would explain the anemia that devoleps in prematurely born infants.

THE FEEDING CARE OF THE INFANT IN THE OBSTETRICAL NURSERY. DR. FRANK C. NEFF.

From his experience of the last three years in the obstetrical nursery of a charity hospital, the author has collected the record of 718 newly born infants. He separates these into two groups, those below and those attaining or exceeding their birth weights when leaving the hospital on the twelfth day. The two groups are compared with reference to their feeding and gaining characteristics during the newly born period. In the study of 678 infants, there were 342 who did not regain their initial weight by the twelfth day and 336 (46.2 per cent) who regained or exceeded it. In a later small series of ninety-one consecutive infants, there were 69 per cent in this favorable group.

The amount of the physiologic loss of weight is greatest in the infants who later are slow to regain their birth weight, and it occurs on an average between the third and fourth days in this class of infants.

In the group regaining the birth weight promptly, it was found that this occurred on an average at seven and one-half days. The most favorable birth weight for early gaining is in the groups weighing 6 and 7 pounds, 61.9 per cent of the former and 51.2 per cent of the latter being in this class.

For the last three years in this nursery, the amount of each breast feeding has been determined and recorded. The average amount of breast milk taken by infants in the second five days of the newly born period is about the same whether complementary feedings are given for the first few days of life, if this short period of mixed feeding is carefully regulated. Plenty of breast milk or some complemental feeding is of value in assisting the infant to regain his birth weight more promptly. It is seldom necessary to use mixed feeding after the fifth day, except when the mother's breasts show little evidence of filling up. The author found that a complemental formula of cow's milk with the food value of 20 calories per ounce was well tolerated as an additional food.

Forty-two per cent of the infants got milk from the breast during the first twenty-four hours, as much as from 1 to 6 ounces (30 to 178 cc.). Such infants usually continue to get larger amounts each day up to the sixth or eighth day and seldom need any complemental food. The nursing interval is at eight hours for the first twenty-four hours, and every four hours thereafter. The long interval between nursings and the short period of eight minutes at the breast seem to be of decided benefit in preventing cracked nipples and interference with lactation.

Eighty-two per cent of the infants left the hospital when they were entirely on the breast; 16 per cent were on mixed feeding and 2 per cent on the bottle alone. This includes infants of all weights from 3 to 10 pounds (1.4 to 4.5 Kg.). In a recent highly favorable series of ninety-one consecutive cases, four infants were on mixed feeding when leaving the hospital, and none on the bottle alone.

The author discusses the value of careful technic in the nursery and the necessity for experienced supervision by physician and competent nurse.

DISCUSSION

DR. SCHICK: I was very glad to hear Dr. Neff's paper because I can confirm everything that he has said about supplemental feeding and loss of weight. For the past ten years I have been fighting for the idea of additional feeding of the new-born child. My attention was first called to this subject in the clinic at Vienna. I try to avoid this initial loss of weight by forced feeding and have succeeded. One thing is pleasant to observe, that the child will look much better, and will seem stronger and happier.

I have forced additional feeding only to the so-called minimum which supplies the child with the food necessary to cover the "basal requirement." As we did not have enough nurses present to care for all of the children in this way, I concentrated my attention on those weighing below 2,500 Gm. The others did not receive this treatment because I thought starvation was less dangerous for them. I gave them breast milk or whole milk with the addition of sugar and on the mixed feeding got excellent results. So I make a plea for the new-born child who cannot speak for himself, that he should not be punished by starvation. I think starvation is dangerous for the new-born child.

Additional feeding in the first days does not interfere with breast feeding. To the contrary, it helps the breast feeding, because the new-born child, strengthened by additional feeding, is better able to empty the breast than the weak, starving newly born child.

DR. CHARLES HERRMAN, New York: Some years ago, I had results similar to those that Dr. Schick has just mentioned (*New York M. J.*, Jan. 9, 1915). I think that most of the textbooks say that if nature intended that an infant should have something for the first few days it would have been provided. It was customary for the grandmothers to give the babies some sugar water for the first few days, and that practice was greatly condemned. As a matter of fact, if they are given the sugar water for the first few days, even without the milk, it will be beneficial. I think it is a mistake that the textbooks have taught that it is not correct to give some food for the first few days.

DR. ROYSTER: I have been interested in this paper because in the University of Virginia Hospital we are doing essentially the same work that Dr. Neff has been doing. Before I took charge of that department the new-born babies were under obstetrical care and were leaving the hospital on the fourteenth day, without regaining their birth rate. They are regaining that now with complemental feeding. We do that up to what we consider the caloric requirement, but we find that individual children of the same weight differ in their caloric requirement. Some wil gain weight on much less caloric requirement than we think necessary, and others will require a great deal more.

We use breast milk for supplemental feeding only to the extent that the mother's breasts need stripping, and at other times we use acidified milk. After these infants are dismissed, they are followed up by the outpatient nurse and are brought back periodically. We find that it is the usual rule that these children make better progress during the next six months than the children who have not been fed the supplemental feedings, and we feel that we have made a distinct gain in the nutrition of the new-born infant in that way.

DR. TAYLOR: This is my thought, that while it is true that most new-born infants are not tempted from the breast by the bottle, yet in individual cases when the baby is 7 or 8 days old it is absolutely necessary to discontinue complemental feeding if the baby is to be breast fed.

DR. ROYSTER: To overcome the difficulty spoken of by Dr. Taylor, we do not give the baby the bottle but give the complemental feeding with a medicine dropper, and the size of the rubber nipple and the medicine dropper do make a difference.

DR. NEFF: I should like to emphasize that in the first twenty-four hours in 42 per cent of the mothers, there is a considerable amount of milk which certainly should be utilized in feeding these children.

In the second place, we were interested to find that the weight on the twelfth day was in direct relation to the amount of the physiologic loss and the day on which the maximum loss occurred.

MASSIVE COLLAPSE OF THE LUNG (POSTOPERATIVE) IN A CHILD. DR. F. C. RODDA.

Doubtless, postoperative massive collapse of the lung has in the past often been confused with pneumonia, thrombosis and infarction of the lung. It is for this reason that the author reports a typical, uncomplicated case and also because an analysis of the case may throw some light on its etiology.

An appendix showing beginning gangrene was removed from T. H., a boy, aged 12, Jan. 10, 1927. The following day, hoarseness and almost complete

aphonia were present. Cultures were negative for diphtheria. The next day, the hoarseness and aphonia had almost entirely cleared, but the patient complained of pain in the chest. On the fourth day, seventy-two hours after the time of operation, the patient was suddenly seized with severe dyspnea. The respiration rate rose to 55, the pulse was 130, and the temperature was 104. The following day, the apex beat of the heart was found in the left anterior, axillary line, and the roentgenogram showed a displacement of the heart entirely into the left side of the chest with a dense, homogeneous shadow in the entire field of the left lung. Subsequently, the child improved speedily; the temperature, pulse and respiration soon returned to normal. A series of roentgenograms showed the clearing of the lung field and the return of the heart to its normal position by the tenth day. It is suggestive that an acute, rapidly clearing laryngitis was followed by a cough, sudden dyspnea and massive collapse of the lung. It is assumed that the same inflammatory change that occurred in the larynx had spread down into the bronchi, causing occlusion and prevention of the entrance of air. Subsequent absorption of air induced collapse or atelectasis of the lung. It appears sound to accept the etiology in this case as an inflammatory or vasomotor change or a combination of both.

DISCUSSION

DR. SCHICK: I was interested in these demonstrations because I have seen several cases of massive collapse in the surgical ward. A few weeks ago I saw a child who had tuberculosis with total collapse of the lungs. This child, aged 5 years, had become ill five days before admission, with a slight temperature. The next day the child was peculiarly dyspneic. It was hard to find anything on physical examination, and I was surprised later to see the roentgenogram. The heart was pushed over to the left side and the whole left side was cloudy. The next day the child felt better. Five days later, a roentgenogram was made. The original collapse cleared up quickly. I do not know how to explain with certainty the condition of the mediastinum. There are two possibilities—first a compression of the main bronchus from the outside by enlarged tuberculous glands. The second possibility is what Jackson mentioned, a mucous plug obturating the lumen of the main bronchus.

DR. GRIFFITH: I should like to call the attention of the members of the society to a case that I reported about a year ago. It is the one to which I referred in my paper today. It was remarkable and at first without any explanation. A new-born infant that had difficulty in swallowing, seemed to choke over its food when nursing, and we could not understand why. The infant was brought to the hospital so that it could be watched, and it seen developed what I thought at the time was a pneumonia, but which afterward proved be a collapse of the lung. This was not an ordinary atelectasis, such as is common in new-born infants who are weakly, but a genuine massive collapse of one lung. It was evident that the infant had had a temporary occlusion of a large bronchus, either by mucus or possibly even by a small amount of food that had gone down and that irritation of the bronchus had caused temporary closure.

DR. FOOTE: It might be of practical importance to remember that Jackson not only has written of this condition and its etiology, but also has reported good results by the use of the bronchoscope and aspiration of mucus plugs in this condition. He and Lee, a surgeon of Philadelphia, have reported a number of cases in which this expedient was employed with prompt and remarkable benefit to the patients.

DR. ABT: Many similar cases were reported, especially by English authors, during the war in adults, caused by bullet and gunshot wounds producing traumas to the chest. Frequently, collapse of the lung was shown on the side opposite to that which was injured.

The case of massive collapse which I reported occurred in a child shortly after appendectomy, this was also noted in Dr. Rodda's report. One should remember the rôle of trauma and surgical intervention as a possible etiologic factor.

BRONCHOPNEUMONIA WITH PROLONGED TOXEMIA AND ANOREXIA — RECOVERY. DR. J. H. M. KNOX, JR.

The case reported is that of a boy, aged 3¼ years, the first child of healthy parents and himself an unusually vigorous specimen.

In December, after a few days of malaise and a slight temperature, he suddenly became acutely ill with high temperature, rapid pulse, cough and anorexia; signs of bronchopneumonia were present at the right base with bronchitis in both lungs. He soon lost consciousness and remained in semi-coma for fifty days. During this time, he was successfully fed by nasal gavage.

The temperature fluctuated from 103 to 106, and his pulse varied from 120 to 180 a minute; respirations were from 32 to 44. He was occasionally cyanotic and required stimulation and oxygen. Salt solution was repeatedly administered intraperitoneally, and during a period of five critical weeks nine intravenous blood transfusions were given. At the height of the illness, there were a number of small intestinal hemorrhages. The leukocytes were remarkably low — from 4,000 to 5,000 in frequent counts. The hemoglobin rose from 40 to more than 80 because of the transfusion.

Blood cultures were repeatedly made, usually before each transfusion, but they did not show any suspicious organisms. Wassermann and tuberculin tests (0.2 Gm. intradermally) were negative. The patient's serum failed to agglutinate typhoid and paratyphoid bacilli at any time. In two spinal punctures, the cerebrospinal fluid was found to be entirely normal.

During the last two weeks of the acute illness, the pulse rate dropped suddenly from 160 a minute to less than 100, there being no change in the heart rate. This pulsus alternans gradually disappeared. After about fifty days, the patient began to have short periods of consciousness; these lengthened; the temperature slowly fell to normal, and he made a complete recovery.

The diagnosis has remained uncertain. I lean to that of severe influenzal pneumonia with intense toxemia.

DISCUSSION

DR. HAND: I should like to ask about the Widal reaction. I think it should be tried again in another month.

DR. CHARLES HENDEE SMITH: Could this child not have had an atypical case of typhoid fever? I have seen a case in which the Widal reaction was positive only once at about the tenth day and in which the examination was made in a dozen laboratories later and was never positive again. Dr. Wood of St. Luke's Hospital says he has observed the condition repeatedly, the Widal reaction being positive only during a few days of the illness.

DR. ABT: How do you explain the long continued unconsciousness of this patient which lasted about fifty days?

DR. HEIMAN: I should like to have Dr. Knox tell us what the differential count was. One can see the leukopenia, which is not unusual in influenza. It is not uncommon to find such a differential count in other conditions. I

think one could absolutely rule out typhoid fever after finding a high leukocytosis. It might be an encephalitis, with this undoubted toxemic condition and the unconsciousness, but I think Dr. Knox's diagnosis is correct, of toxic encephalitis and influenza.

DR. KNOX (closing): In reply to Dr. Smith's question, the blood and the stools were repeatedly searched for typhoid organisms with completely negative results, and the Widal test, made several times during the long illness and again two months after recovery, was completely negative.

I feel that typhoid fever can safely be ruled out in this case.

HYPOPITUITARISM; CONGENITAL PITUITARY TUMOR; OPTIC NERVE ATROPHY. DR. CHARLES GILMORE KERLEY.

The case which I am to report is that of a girl, aged 17, showing the classic signs of hypopituitarism who has been totally blind since she was 10 years of age.

Evidently there was some ocular disturbance at the seventh year, for at about this time she was examined by Dr. Henry B. Chandler of Boston who, in a private communication, reports the following:

"Well nourished girl suffering from vertical nystagmus, more marked in the right eye, no complaint about vision."

The early history of the patient is incomplete; the parents are Christian Scientists, and the girl was brought by an aunt without the knowledge of her parents. The aunt's knowledge of the child was to the effect that the disturbance of vision began between the seventh and the eighth years, that she was totally blind at the tenth year and that there never had been medical observation or treatment other than the one examination by Dr. Chandler. The patient was of the typical hypopituitary type—height, 54¾ inches (138 cm.); weight, 94¾ pounds (42.9 Kg.), this being 20 pounds in weight over height and 11 inches under height for age.

Her mentality was normal, and she conversed intelligently regarding her illness but without supplying much information as to the onset other than that her sight gradually failed. She had never menstruated, and there was an entire absence of pubic and axillary hair. There was no development of the mammary glands. The external genital development was that of a girl about 10 years of age.

A roentgenogram of the skull showed a greatly enlarged sella turcica. The measurements were as follows: anteroposterior, 2 cm.; vertical, 1.5 cm. The reading of the roentgenogram was made by Dr. L. G. Cole:

"The cranial vault is normal in contour and the bones of the cranial vault are apparently normal in thickness. The suture lines are shown distinctly, and there is no spreading of the bones at the sutures. The digitate markings on the internal surface of the skull are more prominent than in the normal skull, and I believe that this is an indication that there is an increased intracranial pressure.

"The sella turcica is very large. I believe that the cavity of the sella turcica is approximately three or four times larger than normal. The anterior clinoid processes are well developed and are not eroded. The sphenoid sinus is very small and does not extend beneath the floor of the sella. The bone of the floor of the sella is smooth and of normal density and apparently not eroded. The posterior clinoid processes and dorsum of the sella are long. There is no apparent erosion of the dorsum of the sella. The apparently normal formation of the bone of this sella would indicate that the pituitary gland has been

large from at least early in childhood and that the formation of bone has accommodated itself to this large size of the pituitary gland."

De Schwienitz, in his Bowman lecture of 1923, "Ocular Aspects of Pituitary Body Disorders," states that "in the majority of the cases involved, the optic chiasma is so located that pressure or stretching or both would be exercised upon its cross fibers by a tumor of the hypophysis of sufficient size to progress toward the Chiasma, also the chiasma ends of the optic nerve would be subjected to the same influences perhaps more on one side than the other" with resulting atrophy.

The size of the sella turcica and the typical hypopituitary picture indicate congenital or early pituitary tumor. Ocular defects at about the seventh year suggest that at this period a cystic degeneration developed with destructive pressure on the optic nerve tract.

DISCUSSION

DR. HAND: Was there any history of polyuria?

DR. KERLEY (closing): I do not know of any history. The aunt who brought this child to me did not live with her, and all I know about the patient I have stated in my paper. I made an appointment with an oculist to examine the child's eyes, but the appointment was not kept.

Fourth Session, Saturday Evening, May 14

DERMATOLOGICAL CONDITIONS AS SEEN IN CHILDREN. DR. A. BENSON CANNON (by invitation).

Eczemas and impetiginous infections are the most frequently seen dermatologic conditions in infants and young children. For convenience, the commoner forms of eczemas can be divided into three groups, being classified according to etiology, as infantile, seborrheic and pyogenic.

Infantile eczema usually occurs in infants from 3 weeks to 6 months of age, appearing as a bilateral, symmetrical, diffuse, catarrhal dermatitis on the cheeks and often extending to other parts of the body. Seborrhea occurs first on the scalp as a dry, finely scaly condition and on spreading to the body, the lesions are sharply demarcated erythematous patches, the scales being dry or slightly oily. Pyogenic eczema begins as staphylococcic infection beneath the vernix caseosa and gradually involves the scalp, face, and body as a sharply defined red, crusted, purulent condition. Other conditions analagous to and simulating these eczemas but of different etiology and requiring somewhat different treatment are mycotic infections, infectious eczematoid dermatitis and so-called "candy" eczema.

Of the impetiginous infections, simple impetigo is the most prevalent, occurring usually on the exposed parts of the skin as an erythematous, vesicular, bullous, yellow and waxy, crusted condition. In new-born infants, it sometimes becomes generalized, appearing as an epidemic in hospital nurseries, and often ending fatally. Another impetiginous infection (Ritter's disease) also occurs in the new-born as a generalized, moist, exfoliative dermatitis of streptococcic origin. This type also frequently ends in death. There is a follicular impetigo (Bockhardt) usually beginning as a papular and pustular eruption which often spreads over the entire body and extremities, and which may prove fatal.

Two dermatoses encountered in early life and characterized by intense itching are prurigo mitis and lichen chronica simplex. While dissimilar, both have often been attributed to protein sensitization and both are chronic.

Being able to distinguish between the several types of eczemas and recognizing the form of treatment indicated often enables one to predict with some degree of certainty the results that can be obtained in the individual case. While it is impossible to effect a cure in all children suffering from true infantile eczema, the condition can always be alleviated for a longer or shorter period. Impetiginous infections, except sometimes in the new-born, can usually be promptly and permanently cured by the ordinary antiseptic and antiparasitic remedies.

DISCUSSION

DR. J. C. GITTINGS, Philadelphia: What proportion of these cases are actually proved to be protein sensitive?

DR. CANNON (closing): It is difficult to say because I think that all cases of infantile eczema are really due to some sensitization. Just what this is I do not know. I class 39 per cent as infantile eczema due to some sensitization.

ANTIMENINGITIC SERUM: HOW OFTEN AND WHEN TO CEASE? DR. LINNAEUS EDFORD LAFETRA.

As frequent injections of serum into the spinal canal are at times followed by an increase in the number of cells or by a rise in temperature and troublesome skin eruptions and, if the injections are discontinued before the spinal fluid in sterile, relapses occur, it would seem of value to have the consensus of the American Pediatric Society on the question of the frequency of administration and the right time to discontinue the spinal injections. There is a tendency in hospitals to give too many injections, and in private practice to discontinue the injections too soon.

Although the severity of the meningeal symptoms, the temperature and the leukocyte count are good general guides, and the reduction in the number of the cells in the spinal fluid is a favorable sign, an additional safe criterion is the presence or absence of micro-organisms in the spinal fluid, as determined by smear and by culture.

Daily spinal taps and injection of serum are required for several days in the average case; severe cases need more frequent administration, twice daily at first, and require additional early intravenous injections if of the septic type. As the cell count and the organisms diminish in number, the injections may be made at two day intervals.

The injections should not be discontinued until the spinal fluid does not contain any viable organisms. Even after the injections have been stopped, the spinal fluid should be examined after a few days' interval to make sure that there has been no increase in the cell count, and that organisms are still absent. Neglect of this procedure has resulted in relapses untreated for varying periods, occasionally with fatal outcome.

DISCUSSION

DR. BLACKFAN: I should like to ask Dr. LaFetra to say a word in relation to the serum that he used. I think it is most important to keep in mind the fact that one occasionally finds an infection in which the serums from the Health Department do not seem effective. Of course, that is shown by the continuation of the clinical symptoms and the continuation of the organisms. Because of the importance of having serums that will be effective for the organism which is causing the meningitis, I think it would be of interest to us and of importance to have him say a word in relation to that point.

DR. CHARLES HENDEE SMITH: Dr. Neale sees all of the patients of this kind at Bellevue and a great many elsewhere, and I have a great deal of respect for her judgment and experience; nevertheless, she occasionally advises us to stop the serum sooner than I think it is wise to do so. In other words, when she gets no more organisms on smear and culture, she thinks it is time to stop. However, when the temperature and the blood leukocytosis continue, I think one should go on with it. The culture takes time and the smear is not always accurate. In several cases recently I have stopped on Dr. Neale's recommendation, but the children have not done well, and they had to be given a few more doses. I think the general indications are not to be forgotten, especially the blood leukocytosis.

DR. HEIMAN: Most of the serums that are manufactured today so far as I know are polyvalent, but one must not lose sight of the fact that in meningitis also, cases are encountered that will not respond to any serum. In other words, in these cases the bacteria may generate antibodies against the serum. Some of the patients were injected twenty or thirty times without avail. It has been the custom that when meningitis occurred to treat the severe forms intensively—at the very beginning, that is to treat them intravenously, intraspinally and subcutaneously. In fact some go so far now as to inject the serum into the cisterna magna, and I think it is best in many cases.

DR. FOOTE: It may be of interest to know that the Hygienic Laboratory reports a slight increase throughout the country of cases of meningococcus meningitis which are apparently caused by a different strain from the strains for which the commercial serums are made. Our polyvalent serums are largely derived from strains obtained during the World War. There have been one or two such cases at the Children's Hospital in Washington, in which a slight temporary improvement occurred after the use of serum, with a later exacerbation of clinical symptoms and increase of organism in the spinal fluid. Resistant strains of meningococci should be sent to the Hygienic Laboratory for distribution to manufacturers of serums.

DR. JULIUS H. HESS: Among the most troublesome things that one has had to contend with in coming to a decision as to further need for serum therapy, have been, first, the recurrence of symptoms during the stage of anaphylaxis following the use of serum, and second, the symptoms so frequently seen during convalescence which are due to increased intracranial pressure.

The latter are likely to continue for a considerable time after the organisms are killed and, while calling for repeated spinal punctures to relieve pressure, further serum is contraindicated.

For many years we have been making repeated total and differential blood counts during the course of our cases of meningitis. Cellular examinations of the blood cannot have any diagnostic value in themselves, but must be considered in their relation to the other clinical symptoms. However, much can be learned as to prognosis by regular examination of the leukocytes. To be of definite value, however, the blood examinations should record the absolute number of each variety of cells and not their percentages. This is especially true in children in whom there is a considerable variation in the blood picture during their early years. In epidemic meningitis, the neutrophils are always the predominating cell before the administration of serum. During convalescence, if the patient is carefully followed, at some stage they will be found to be below the normal in number. The lymphocytes vary only moderately from the normal during the acute stage, while during convalescence there

develops a moderate but absolute lymphocytosis. Therefore in all cases there is an approximation and in some an actual crossing of the neutrophil and lymphocyte curves during convalescence.

Eosinophils disappear absolutely early in the infection and do not recur until convalescence has set in. With recrudescence and the reappearance of organisms in the spinal fluid, they again disappear. Following the withdrawal of spinal fluid and the injection of serum, there may be an increase in the total white and neutrophil count with a decrease of eosinophils, but in our experience, although the late anaphylactic reactions may be associated with a rise in temperature, the polymorphonuclear cells remained low and eosinophils were present. Although there may be a distinct increase occasionally, at no time in our series of cases was there a marked eosinophilia. The presence and reappearance of eosinophils in our cases was always associated with signs of good omen.

Every case must be studied individually with reference to the symptoms presented, not only as to the presence of meningitis, but also as to the possibility of secondary infections.

A drop in the neutrophil count with an increase in the lymphocytes and a reappearance of the eosinophils indicates a good prognosis. An approximation of the neutrophil and lymphocyte curves is of good import.

The leukocyte count is of most importance as an indicator for further prognostic punctures or the need of serum. An increase of the neutrophils and temperature with disappearance of the eosinophils should always lead to further spinal puncture.

The temperature and cerebral reactions often associated with late anaphylaxis can be interpreted by careful leukocyte counts, and the further injection of serum, with its accompanying dangers, may be avoided. The neutrophils remain low and the eosinophils usually are present during this stage.

This study of differential blood counts has covered a period of more than fourteen years. I first made a report on the value of these studies before the Section on Diseases of Children of the American Medical Association at Minneapolis in 1913, and feel more strongly than ever today that such examinations have great prognostic value.

Dr. Wilburt C. Davison, Baltimore, Md.: In addition to the question of how long one should give serum, the question of how frequently it should be given during the first two or three days is important. Dr. Harold L. Amoss injected antimeningococcus serum intraspinally into monkeys and then tested the spinal fluid at short intervals. He found that antibodies usually could not be demonstrated longer than eight hours after the injections. So on that basis our routine practice has been to treat the children intraspinally every eight hours for the first two days, then twice a day for the next two days and then daily for two or three days. Spinal punctures without injections of serum are done every twenty-four hours for the next few days. The administration of serum is usually discontinued on the sixth day, but the patient's condition is the criterion, for the cell count practically always remains between 150 and 200, merely because of the irritation of the serum itself.

If all of these punctures are made in the lumbar region, irritation or even an abscess may be produced. Therefore, the first puncture is made in the lumbar region, the second one in the occipito-atlantoid space (cisternal puncture) and so on alternately. I feel that treatment by both routes is more beneficial than by either one alone. In the several hundred cisternal punctures done in the Harriet Lane Home during the past few years, no untoward results

have occurred. If the flow of spinal fluid from either space is blocked, ventricular punctures are done, and treatments are given.

The type of serum used is important. I have had six patients in the last five years who were not benefited by the first serum used but when treated with another serum the organisms disappeared from the spinal fluid and recovery followed. If the organisms do not disappear after the first three treatments, another manufacturer's serum is usually selected and the patient is treated with that. Of course, the only accurate way to know whether it is going to be effectual is to grow the organisms and to perform an agglutination test with the therapeutic serum, but that requires forty-eight hours and merely examining the smears for the presence of the organisms is perhaps just as satisfactory.

Dr. Richard M. Smith, Boston: In reference to the injection of fluid by any other method than the lumbar route, cistern punctures have been done and fluid injected by that method. It is well to bear in mind that that method of administering serum is not without danger. It is probably not dangerous to withdraw fluid from that area of the spinal canal provided one's technic is perfect, but the increase in pressure which follows the injection of serum may result in serious consequences. If it is necessary to administer serum by some other route than the lumbar, it has been found much safer to tap the ventricles. In children in whom a ventricular tap cannot be done without trephining, a simple trephining is employed preliminary to the withdrawal and administration of fluid rather than to incur the risk, which is considerable, of injecting fluid by the cistern method.

Dr. LaFétra (closing): In regard to Dr. Blackfan's question, I did not take up the general treatment of meningitis, and the answer is the same as that given by Dr. Davison in regard to changing the serum. Generally, the serum from the New York City Department of Health is used. I have had occasion to change to some other serum but seldom in the last few years.

In regard to discontinuing the serum while symptoms of meningitis are still present, I have not advocated such a thing at all. It is known that infants got well before we had any serum at all, but the question is when is it safe after the symptoms have disappeared to discontinue the serum? I think we must take all the factors into consideration, and especially the spinal fluid cell count and the presence or absence of micro-organisms.

In regard to Dr. Hess' remarks about the counting of the eosinophils and the lymphocytes, I have not had any experience with that.

The Practicability of Immunization with Combined Toxin. Dr. Frederic W. Schlutz and Dr. Howard Eder.

By the use of toxin-antitoxin and universal application of immunization, it seems practically possible to eliminate diphtheria entirely. The immunization against scarlet fever is not so certain and complete but is accomplished in an overwhelming percentage of cases.

The skin reaction in the form of the Schick and Dick tests is widely used as a test of susceptibility in both diphtheria and scarlet fever. The interpretation of the reaction is not always easy. The mechanism of the skin test is apparently complicated. It is not necessarily a measure of the presence of antitoxin in the blood, although as far as diphtheria is concerned, it evidently is a measure of resistance.

The significance of the Dick test as bearing on susceptibility to scarlet fever still seems to be a mooted question. The Dick test does not seem to be

closely bound up with the antitoxin content of the blood stream. In spite of its shortcomings, it is, along with the Schultz-Charlton blanching phenomenon, the best objective diagnostic measure we possess for differentiating scarlet fever from nonscarlatinal diseases accompanied by rash.

The possibility of successfully immunizing against two or more diseases at the same time would be highly advantageous and of great importance in assuring a successful immunization campaign.

The work of Larson and his associates has shown the feasibility of using combined vaccines of diphtheria and scarlet fever by detoxifying the respective toxins with sodium ricinoleate. This agent detoxifies certain bacterial toxins without altering their antigenic properties. Diphtheria and scarlet fever toxin may be combined with sodium ricinoleate in such a way that 3,000 skin test doses of scarlet fever toxin with 0.1 L+ dose of diphtheria toxin can be injected without causing any symptoms other than a mild local reaction. Three injections are given in weekly intervals. Children injected with this immunizing material give a negative reaction to both scarlet fever and diphtheria toxin.

The absence of horse serum is an advantage of this vaccine. It is also stable under all conditions of temperature. The experimental work of Larson would indicate that the detoxification of bacterial toxins is an adsorption phenomenon. The toxin molecules adsorb the surface tension depressant (sodium ricinoleate) and are at the same time detoxified.

The clinical material subjected to combined immunization and reported here was drawn from two sources. Thirteen thousand school children of Minneapolis and 524 school children from a neighboring village were immunized. The technic indicated above was followed. There were no general or severe reactions. Of the Minneapolis children, sixteen developed scarlet fever and two diphtheria. Of the smaller series of 524 cases, 90.6 per cent gave negative reactions to the Dick test at the end of three months.

The satisfactory result of both series would indicate that immunization with combined vaccines is not only possible but apparently also successful. Clinical results so far certainly indicate that diphtheria and scarlet fever toxins can be combined wthout giving untoward toxic reactions. They can be given in large dosage with complete safety and with more than reasonable assurance of certain immunity.

DISCUSSION

DR. HELMHOLZ: We have used some of Dr. Larson's material in immunizing children against both scarlet fever and diphtheria, and have used the Larson material as compared with the toxin-antitoxin furnished by the State Board of Health. The percentage of negative Schick reactions in the group in which we used the Larson material was a little better than that in the group in which we used the toxin-antitoxin, so that, with regard to diphtheria, in avoiding the sensitization with the antitoxin I feel that there is possibly an advantage in using the simple toxin.

I cannot agree with Dr. Schlutz, however, in regard to the negative reactions. In a total series of about 783 inoculations with 3,000 skin test units there were seven children with febrile reactions up to 102, and eight children developed a definite scarlet fever rash. It seems to me that one should be careful in combining a procedure that is of known prophylactic value, as immunization against diphtheria, and a procedure that is at present still decidedly in the experimental stage — the immunization against scarlet fever. I think we owe it to the public to let them know that active immunization against scarlet fever is an experiment and not at present a recognized public health procedure.

DR. SCHICK: As to the question whether toxin-antitoxin should be injected and detoxified, Dr. Park himself feels, as he reported in a discussion, that it is necessary to collect much more data on this subject. He is trying out the Ramon method, but he desires to wait at least two more years before dropping the well established method of toxin-antitoxin injection in favor of another method in order to be sure that the new method gives the same satisfactory results. He feels, just as Dr. Helmholz has said, that it is a duty to the public not to use two methods at the same time. Only after thorough investigation and when we know exactly what the results will be, should we change our procedure. I agree with him that we should wait at least until we have collected more material.

DR. SCHLUTZ (closing): We are, of course, not urging this method of immunization on the public. That must be clearly understood. It is our intention to feel our way as carefully as all other investigators in this field are doing. I did feel, however, that it was desirable to present some of these figures here before this body at this time. While it is true that the method is still in the experimental stage, it does seem that there are about it certain advantages that cannot be denied and that may possibly prove of far-reaching importance and may give it a wide sphere of usefulness.

PERIBRONCHIAL PULMONARY INFILTRATION AFTER RESPIRATORY INFECTIONS IN CHILDHOOD; A CLINICAL SYNDROME. DR. HENRY HEIMAN and DR. PHILIP COHEN.

For the past three years we have encountered with increasing frequency a syndrome of pulmonary dulness on percussion, fever and cough. Sometimes no cough is present, and often in the later stages fever is absent. The pulmonary dulness, however, is constant, usually bilateral, and persistent, for this lesion tends to be a chronic one. This pulmonary infiltration frequently follows grip, measles and colds, and less frequently pertussis, diphtheria and scarlet fever. The striking feature on physical examination is the absence of râles, bronchial breathing and bronchophony. The general appearance of the patient depends on the toxicity of the primary disease, which is not augmented by the pulmonary involvement, but the high fever is often prolonged as a result of the peribronchial infiltration, and a low grade fever for weeks is common. In short, the clinical picture and signs are different from the typical or atypical pneumonias of childhood.

The prognosis is good, for we have had no mortality, and hence no pathologic material for a morphologic study. A careful perusal of the literature on the pathology and pathogenesis of pneumonia indicates that we are dealing with an interstitial pneumonia without alveolar exudation, as described by Delafield and Steinhaus, both of whom stress the chronicity of the lesion. This is the only pathologic condition that can plausibly account for the constant physical sign of dulness on percussion without râles or any changes in breathing except diminution. This type of pneumonia is caused by *Streptococcus hemolyticus*, which has long been known for its predilection for the interstitial tissue of the lung.

Roentgen-ray studies have revealed a fine mottling of the lungs, usually the lower lobes, in about half of the cases. In most of the others there was an accentuation of the lung markings, which alone is usually difficult to interpret as indicating pathologic changes. Negative roentgen-ray examinations with unquestionable thoracic dulness argue for rather than against the diagnosis of peribronchial infiltration.

The treatment is an outdoor one with the invocation of roentgen-ray therapy in the chronic cases, when the dulness on percussion persists.

DISCUSSION

Dr. Sisson: Was tuberculosis definitely excluded in this group of cases?

Dr. Kerley: I should like to ask Dr. Heiman if he has made any observations by the roentgen ray on any considerable number of cases of children who have had whooping cough or influenza in which fever is not present but in which there is a fairly persistent cough, that being the most pronounced symptom and the feature for which the child comes in.

Dr. Heiman (closing): In regard to Dr. Sisson's question, we always think of the possibility of tuberculosis. In fact, many of the roentgenologists have reported these cases as cases of tuberculosis, but there is no clinical or roentgen-ray evidence or tuberculin tests of tuberculosis.

In regard to Dr. Kerley's question, every child with a chronic cough that comes to us is examined for a symptom of this type. Of course, this does not mean that in every case the cough is due to a peribronchial condition. The child may have mediastinal or brochial glands or other thoracic pathologic condition causing the cough.

The Prevention and Treatment of Thrush. Dr. Harold K. Faber and Dr. Esther B. Clark (by invitation).

A hospital epidemic of twelve cases of thrush in new-born infants occurred in spite of a supposedly adequate preventive technic.

The affected infants were as vigorous, well-nourished and healthy as the unaffected. There was no correlation between infection and the manner of feeding or handling, nor were there preceding disorders of any sort to act as predisposing factors.

A careful survey discovered in certain relatively inaccessible places near the bathing table hitherto unsuspected deposits of dust. When these were removed the epidemic abruptly ceased, and no new cases have appeared in the supervening two months.

Preventive technic not only against thrush but also against other infections of the new-born should include strict cleanliness of the nursery enforced by frequent and thorough inspection; sterilization of nipples and bottles and of all supplies to the ward; thorough washing of hands before each handling of the infants and after changing diapers; frequent inspection of the infants' mouths and prompt isolation of detected or suspected cases, and cooperation by the obstetrician in reporting evidences of infection, particularly vaginal, in mothers. Since the oidium is destroyed by moist heat at 70 C. for one minute. brief boiling of bottles, nipples and solutions is adequate for sterilization.

In treatment, certain dyes are much more effective than any other means. Alkalis and boric acid are valueless except for cleansing purposes, and boric acid, given in relatively large amounts as in the Escherich teat, might readily produce toxic effects. Of the dyes, gentian violet appears at present to be the most effective. It is used in 1 per cent aqueous solution, freshly prepared, and is painted on the mucous membrane of the mouth after careful preliminary cleansing. Repeated once or twice daily for the first three days and thereafter every other day for about a week, applications cause the lesions to disappear rapidly, usually by the end of the second day. Recurrences are not uncommon when the dye is applied only once or twice.

DISCUSSION

Dr. Brennemann: I wondered whether there was any striking difference in the nutritional state of the children with thrush as compared with those that did not have it? Czerny has said that the healthy baby never has thrush.

Dr. Neff: Having seen good results from the use of borax solution in the mouth, I would like to ask if Dr. Faber has used it.

Dr. Charles Hendee Smith: Was the nursing controlled by the private nurses or the ward nurses? In the Sloane Hospital for Women, most of the infections come from the private nurseries because there are so many nurses going in and out and more infants for the same sized room. The likelihood of infection is increased in direct proportion to the number of contacts.

Dr. Sisson: Another infection occurred this year with us. A number of infants developed thrush, and it was the feeling that it was not on the whole important. There were one or two bad experiences in which gavage or lavage was used, however, and it does seem true that thrush can go further down and infiltrate the stomach and intestines and cause lethal results.

Dr. Abt: Is not nitrate of silver solution almost specific in the treatment of all these cases?

Dr. Faber (closing): The infants infected with thrush were as well nourished and healthy as the others, perhaps a little more so.

I might say that we used boric acid years ago in the treatment of thrush, and it probably has no more value than the ordinary washes.

In regard to Dr. Smith's question, we have not allowed any private nurse in our private nursery for the last two years. The infants are delivered at the door of the nursery when the private nurse takes them to the mothers. Some of the infections have occurred in infants who were taken care of by nurses on private duty.

Most of the cases occurred in breast-fed infants. We were fortunate enough to have our premature infants escape.

I think Dr. Sisson's point in not using gavage is a good one, because a slight trauma by the tube might implant the infection in the esophagus.

Bottled Cow's Milk; a Proposal to Limit by Law Its Maximum Fat Content. Dr. B. Raymond Hoobler.

The Anatomic Lesion of So-Called Acute Pyelitis of Infants. Dr. James R. Wilson (by invitation) and Dr. Oscar M. Schloss.

The rarity of pyelitis at postmortem examination in contrast to the frequency with which it is diagnosed clinically is impressive.

For this reason, many doubt the dependence of pyuria in infants in inflammation of the kidney pelvis but seek its origin in some other part of the urinary tract.

During the past seven years, we have obtained data from thirty-eight postmortem examinations on infants whose urine contained pus during life. A study of this material demonstrates, we believe, that the anatomic lesion is in the interstitial tissue of the kidney and is essentially pyogenic in character. In its earliest stages, the lesion is represented by minute foci of round cells and polymorphonuclear leukocytes. These areas vary in number, are widely scattered and may involve some areas of the kidney to a greater degree than others. In more advanced cases the lesions are of larger size and may show necrosis with definite formation of abscesses.

In no case have we observed pyelitis as an isolated lesion. Two of our postmortem examinations disclosed inflammation of the kidney pelvis, but in these, inflammation of the interstitial tissue of the kidney was present and of more marked degree. The anatomic basis of so-called pyelitis of infants is probably suppurative nephritis. This opinion has been expressed by Thiemich, Chown, Bugbee and others.

ONCE MORE, "THE ABDOMINAL PAIN OF THROAT INFECTIONS" AND APPENDICITIS. DR. JOSEPH BRENNEMANN.

The purpose of the present paper is both to reiterate and to extend certain impressions reported to this society six years ago on the occurrence of abdominal pain in the course of throat infections in children, and also to counteract some erroneous interpretations that have apparently followed that report. On a number of occasions, I have seen the diagnosis of appendicitis discounted, or even excluded, because the patient had an infection in the upper part of the respiratory tract at the time. My main purpose at the present time is to present evidence that appendicitis itself is among the complications of those infections and that this fact should be borne in mind when a patient with an infection of the throat has an abdominal pain.

The abdominal pains referred to, outside of that due to appendicitis, are apparently of two types. The first and most characteristic pain usually occurs early, is intermittent and variable in severity and is nearly always located in the region of the umbilicus. It gives one the impression of being a "referred" pain, though no explanation for its genesis is offered. The other pain is less sharply defined, occurs later, is more often accompanied by tenderness and, while it may occur anywhere in the abdomen, it is usually located about the umbilicus or in the lower right quadrant. A mesenteric lymph adenitis would seem the most probable explanation.

That appendicitis can be a complication of, or a sequel to, an infection of the throat would seem evidenced by my own experience; by the simultaneous occurrence of epidemics of appendicitis and throat infections, as reported especially by Evans; by animal experimentation, and by similarity of lymphoid content of the throat and of the appendix. Whether the infection is carried to the appendix by the blood stream (Kretz, Adrian, Poynton and Payne) or whether appendicitis is an enterogenic infection, as championed by Aschoff, Heyde and others, or whether the infection can take place along both routes remains to be determined and does not concern us at this time.

The main point to be stressed is that appendicitis occurs, apparently not infrequently, as a complication of, or a sequel to, an infection in the nose and throat and that the simultaneous occurrence of an infection of the throat and an abdominal pain should not weigh against the diagnosis of appendicitis.

DISCUSSION

DR. NEFF: I simply want to mention the fact that I have seen two cases of proved appendicitis during or at the conclusion of measles.

DR. HELMHOLZ: During the latter half of August and early September, 1926, we had just such an epidemic in Rochester as they apparently had in Chicago later in the winter. It was surprising to see the grouping of cases at this time, and as Dr. Brennemann has covered this topic so fully I merely want to emphasize the importance of the development of appendicitis complicating cases of — for want of a better name — inflammation of the glands

of the mesentery. In two cases, after about an interval of four days, during which time the pain persisted, a definite attack of appendicitis developed.

As Dr. Brennemann has pointed out, the symptoms, of pain without tenderness are of great importance, but these cases must be carefully watched from day to day because in addition to the pain which is probably due to adenitis there may be a development of appendicitis.

In the development of appendicitis it has been our experience, as others have mentioned, that there is always a grouping of cases. We had not seen any cases of appendicitis for several months, and in two weeks before coming away we had about six cases from the city of Rochester, which is a community of about 16,000.

DR. KERLEY: I think there is no doubt that mesenteric adenitis occurs in connection with infections of the throat and that the adenitis may be located in the right lower quadrant, as it was in two cases of mine in which operation was done during the past year. These diagnoses were confirmed by well known surgeons, and in neither of the cases was the appendix involved, but there was a definite adenitis. In one case the gland was as large as the end of my thumb, in the immediate region of the appendix, but the appendix was not involved. I have seen two cases of that sort within two years.

DR. BRENNEMANN (closing): My main purpose, as I indicated from the title, was to counteract the misinterpretation of what I said on several former occasions.

As to Dr. Neff's remarks, I also know of several cases of appendicitis complicating measles that have occurred recently. Many such cases have been reported. They have also been reported in connection with scarlet fever and typhoid fever. However, I was speaking of the nonspecific infections only.

I am glad to hear of Dr. Kerley's experience. I spoke of the region of the appendix, also, as a favored region for lymphadenitis. Some of our surgeons are worried about the whole thing. They are convinced that if the child has an abdominal pain they had better at times, call in a pediatrician in consultation. It is interesting how frequently the pain is located in the umbilical region. The lymphatic glands may be involved, or a slight involvement of the appendix may have something to do with the condition, but one would think there would be more tenderness if that were true.

If I have been able to correct a misinterpretation, and to carry conviction that there is an abdominal pain accompanying some infections of the throat, I have accomplished what I desired.

Dr. Charles H. Smith's paper was postponed until next year, on motion duly seconded and carried, at the request of Dr. Smith, because of the lateness of the hour.

Book Reviews

THE MODERN PRACTICE OF PEDIATRICS. By WILLIAM PALMER LUCAS, M.D., LL.D. Price, $8.50. Pp. 922, with 133 illustrations. New York: The Macmillan Company, 1927.

In this volume the author has deviated from the usual arrangement found in other textbooks in pediatrics. Whether this innovation is an advantage or not must be determined by the individual reader. The text is divided into two parts: one entitled "Infancy" and the other, "Childhood." It is doubtful if this division has any advantage, as many of the subjects that appear under the one division appear also in the other, and this detracts from the work as one of reference, particularly for the physician who is not a pediatrician or the medical student who may not look up the subject in the two divisions and who may thereby not obtain the full information on a subject that may be completely treated in the text. Nor is the division consistent; for example, the author considers infancy as the period of life from 1 year to 6 years, and yet in the chapter on genito-urinary diseases he refers to the individual during the first year, which age elsewhere he terms the nursing period. This same chapter is included under the division on "Childhood" (his period from 6 years to 12 or 14 years). In this chapter he describes the method of obtaining specimens of urine from the "infant or young child."

Another comment must be made on the division of the field of pediatrics into five different periods. The period of nursing and the period of infancy are two new departures from the long accepted classification of the periods of life. In the period of nursing, the author includes the first year of life, whereas this time of life is usually considered as at least a part of the period of infancy. He considers the period of infancy from 1 to 6 years synonymous with the child's pre-school age. It would be difficult to convince most pediatricians, at least, that a child of 5 years is an infant.

A chapter is given to the development of preventive pediatrics. This is a step distinctly in advance in a pediatric textbook. It is well worth reading, and every one interested in pediatrics will have his thoughts along preventive lines stimulated and strengthened on reading this chapter. Unfortunately, the physician, and often the pediatrician, does not give enough thought to the prevention of disease.

The text as a whole covers the field of pediatrics, though some subjects are not treated at sufficient length, as, for example, some of the diseases of the newly born, namely, the different types of icterus and pyogenic infection. Also in feeding the congenitally weak and the premature infant more emphasis should be laid on tube feeding, because to this method of feeding may be credited the lives of many infants that would have been lost with other feeding methods. Incidentally the subject of gavage does not receive the consideration it deserves. The text, however, contains so much information that to treat each subject thoroughly would require a much larger volume.

The illustrations are excellent, and most of them are properly placed. Reference to them in the text is not noticeable, however, and some, as, for example, the illustration of geographic tongue, are not described in the text.

Under the chapter of malnutrition, timely and emphatic reference is made to defective posture. With early attention to the prevention of this condition, more persons would escape malnutritional subnormalities.

The chapter on diseases of the blood is especially to be commended.

In the chapter on infectious diseases general information is given which is of much value. The infectious diseases, however, are considered in one chapter, there being no subdivision into those which are accompanied by eruptions and those which are not.

Undoubtedly, there is much information of great value within the covers of the text. Unfortunately, however, from the point of view of the reviewer, it is not most advantageously arranged, nor are the subjects given commensurate consideration. Unfortunately also, in the final reading of the proofs there seem to have been some oversights; for example, the subject of measles is begun in small type and with no other emphasis than the beginning of a paragraph.

The reference readings which appear at the end of each chapter are an innovation in American texts on pediatrics.

SOCIAL FACTORS IN MEDICAL PROGRESS. By BERNHARD J. STERN. Price, $2.25. Pp. 132. New York: Columbia University Press, 1927.

The first part of this book is concerned with a discussion of the underlying factors that have caused opposition to progress in medicine. Among physicans, vested interests, prestige of existing authority, personal animosity and justifiable scepticism have all played a part. Among the laity, opposition to dissection and to animal experimentation is said to have as a basis an identification of the individual with the corpse or animal.

In the second part, the author shows that new discoveries in medicine are inevitable and depend not so much on the extraordinarily gifted person as on the ripeness of the times.

Directory of Pediatric Societies

NATIONAL

AMERICAN MEDICAL ASSOCIATION, SECTION OF DISEASES OF CHILDREN

Chairman: Dr. Hugh McCulloch, 500 S. Kingshighway, St. Louis.
Secretary: Dr. C. A. Aldrich, 545 Lincoln Ave., Winnetka, Ill.
Place: Minneapolis. Time: To be decided later.

AMERICAN PEDIATRIC SOCIETY

President: Dr. J. Claxton Gittings, 1828 Pine St., Philadelphia.
Secretary: Dr. Howard Childs Carpenter, 1805 Spruce St., Philadelphia.
Place: Washington, D. C. Time: April 30 to May 2, 1928.

THE ASSOCIATION OF AMERICAN TEACHERS OF THE DISEASES OF CHILDREN

President: Dr. J. P. Crozier Griffith, 1810 Spruce St., Philadelphia.
Secretary: Dr. Paul W. Emerson, 86 Bay State Road, Boston.
Place: Minneapolis. Time: Spring.

AMERICAN CHILD HEALTH ASSOCIATION

President: Hon. Herbert Hoover, 370 Seventh Ave., New York.
Secretary: Dr. Philip Van Ingen, 370 Seventh Ave., New York.
Place: Undecided. Time: May or June, 1928.

CANADIAN SOCIETY FOR THE STUDY OF DISEASES OF CHILDREN

President: Dr. G. R. Pirie, 20 Madison Ave., Toronto, Canada.
Secretary: Dr. A. P. Hart, 1844 Bloor St. West, Toronto, Canada.
Place: Vancouver, B. C. Time: June, 1928.

SECTIONAL

CENTRAL STATES PEDIATRIC SOCIETY

President: Dr. O. L. Goehle, 15703 Detroit Ave., Lakewood, Ohio.
Secretary: Dr. H. T. Price, 121 University Place, Pittsburgh.
Place: Cleveland. Time: Oct. 14 and 15, 1927.

SECTION ON PEDIATRICS OF SOUTHERN MEDICAL ASSOCIATION

President: Dr. Robert A. Strong, Pass Christian, Miss.
Secretary: Dr. Hugh L. Dwyer, Medical Arts Bldg., Kansas City, Mo.
Place: Memphis, Tenn. Time: Nov. 14 to 17, 1927.

LOCAL

PEDIATRIC SECTION OF FULTON COUNTY MEDICAL SOCIETY, ATLANTA, GA.

President: Dr. William W. Anderson, 362 Peachtree St., Atlanta.
Secretary: Dr. Lee Bivings, Exchange Bldg., Atlanta.
Place: Academy of Medicine, 32 Howard St., Atlanta.
Time: Second Thursday of each month from October to April, at 8 p. m.

BROOKLYN PEDIATRIC SOCIETY

President: Dr Harold L. Barnes, 1235 Dean St., Brooklyn.
Secretary: Dr. Charles A. Weymuller, 61 Greene Ave., Brooklyn.
Place: Kings County Medical Society Bldg. Time: Last Wednesday of each month, except June, July and August.

CHICAGO PEDIATRIC SOCIETY

President: Dr. Maurice Blatt, 30 N. Michigan Ave., Chicago.
Secretary: Dr. J. K. Calvin, 104 S. Michigan Ave., Chicago.
Place: City Club. Time: Third Tuesday of each month.

THE PEDIATRIC SECTION OF THE ACADEMY OF MEDICINE OF CLEVELAND

Chairman: Dr. Henry J. Gerstenberger, 2103 Adelbert Road, Cleveland.
Secretary: Dr. Charles W. Burhans, 2103 Adelbert Rd., Cleveland.
Place: 2009 Adelbert Road. Time: Four meetings, from September to May.

DETROIT PEDIATRIC SOCIETY

President: Dr. Thomas B. Cooley, 987 Jefferson Avenue, East, Detroit.
Secretary: Dr. W. S. O'Donnell, 1563 David Whitney Bldg., Detroit.
Place: Children's Hospital of Michigan. Time: No fixed date; approximately once a month.

LOUISIANA STATE PEDIATRIC SOCIETY

President: Dr. L. R. De Buys, 1487 Delachaise St., New Orleans.
Secretary: Dr. F. J. Kinberger, 3601 Prytania St., New Orleans.

MEMPHIS PEDIATRIC SOCIETY

President: Dr. F. T. Mitchell, 376 So. Bellevue Ave., Memphis, Tenn.
Secretary: Dr. Arthur G. Quinlan, 1193 Madison Ave., Memphis, Tenn.
Place: Memphis General Hospital. Time: Second Tuesday of each month.

MILWAUKEE PEDIATRIC SOCIETY

President: Dr. Roy M. Greenthal, 141 East Wisconsin Ave., Milwaukee.
Secretary: Dr. M. G. Peterman, 167 Seventeenth St., Milwaukee.
Place: Children's Hospital, Milwaukee. Time: Second Wednesday of each alternate month, beginning with February.

NEW ENGLAND PEDIATRIC SOCIETY

President: Dr. James Herbert Young, 66 Commonwealth Ave., Boston.
Secretary: Dr. Thomas Lanman, 286 Marlborough St., Boston.
Place: Boston Medical Library. Time: Second Friday of each month.

PEDIATRIC SECTION OF THE NEW YORK ACADEMY OF MEDICINE

President: Dr. William Ropes May, 8 East 66th St., New York.
Secretary: Dr. Stafford McLean, 17 East 71st St., New York.
Place: New York Academy of Medicine, 2 East 103d St. Time: Second Thursday of each month from October to May, inclusive, 8:30 p. m.

NORTHERN CALIFORNIA PEDIATRIC SOCIETY

President: Dr. C. F. Gelston, 384 Post St., San Francisco.
Secretary: Dr. Mary H. Layman, 2116 Pacific Ave., San Francisco.
Place: Alternates between Stanford University Hospital, University of California Hospital, and Children's Hospital. Time: Three or four times a season.

NORTHWESTERN PEDIATRIC SOCIETY

President: Dr. F. W. Schlutz, Univ. of Minnesota, Minneapolis.
Secretary: Dr. E. S. Platou, 730 La Salle Bldg., Minneapolis.
Place: University Campus and Rochester. Time: Winter, Spring, Summer, Fall.

PHILADELPHIA PEDIATRIC SOCIETY

President: Dr. Edward L. Baner, Jefferson Medical College, Philadelphia.
Secretary: Dr. John Porter Scott, 2040 Pine St., Philadelphia.
Place: College of Physicians, 19 S. 22nd St., Philadelphia. Time: Second Tuesday of each month from October to June, inclusive.

THE ROCKY MOUNTAIN PEDIATRIC SOCIETY

President: Dr. W. Wiley Jones, Majestic Bldg., Denver.
Secretary: Dr. Berryman Green, 537 Republic Bldg., Denver.
Place: Children's Hospital, Denver. Time: Third Saturday of each month, 2:30 p. m., September to May, inclusive.

ST. LOUIS PEDIATRIC SOCIETY

President: Dr. T. Wistor White, Lister Bldg., St. Louis.
Secretary: Dr. E. H. Rohlfing, 816 Beaumont Medical Bldg., St. Louis.
Place: St. Louis Children's Hospital. Time: At least once a year and contingent thereafter on the arrangement of a suitable program.

SOUTHWESTERN PEDIATRIC SOCIETY

President: Dr. Oscar Reiss, Westlake Professional Bldg., Los Angeles.
Secretary: Dr. Wm. Sidney Bowers, 1136 W. 6th St., Los Angeles.
Place: University Club of Los Angeles. Time: First Wednesday in January, March, May, September and November.

PEDIATRIC SECTION, ACADEMY OF MEDICINE, TORONTO

President: Dr. M. A. Cox, 34 St. Clair Ave. W., Toronto.
Secretary: Dr. F. R. Hassard, 1361 King St. W., Toronto.
Time: November 17, December 15, February 16 and March 15.

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CONTENTS

PAGE

Effect of Therapeutic Doses of Ultraviolet Radiation on Basal Metabolism in Children:

First Paper: Margaret E. Fries, M.D., New York 159

Second Paper: Immediate Effect. Margaret E. Fries, M.D., and Anne Topper, M.D., New York 166

Enlargement of the Spleen in Children. Adrien Bleyer, M.D., St. Louis 176

Pyloric Stenosis of Infants. F. F. Tisdall, M.D. (Tor.); M. W. Poole, M.D., and Alan Brown, M.B. (Tor.), Toronto 180

Inorganic Blood Phosphate: Studies of Rats on Rachitic and Nonrachitic Diets. Elizabeth M. Koch, Ph.D., and Meyer H. Cahan, M.S., Chicago 187

Papilledema and the Diagnosis of Epidemic Encephalitis. Lester Rosenberg, M.D., New York 198

Hiccups Among Infants. Walter R. Pendleton, S.B., Long Beach, Calif. 207

Studies in Pubescent Growth, with Special Reference to Periodic Gain. Borden S. Veeder, M.D., and E. H. Rohlfing, M.D., St. Louis 211

Metabolism of Salts in Nephritis: III. Chlorides and Sodium. Gladys L. Boyd, M.D. (Tor.); Angelia M. Courtney, B.A., and Ida F. MacLachlan, B.A., Toronto. 218

Renal Infantilism: Report of a Case and a Review of the Literature. F. C. Hunt, M.D., New York 234

Chronic Intussusception: An Unusual Type with Prolapse. Oscar B. Markey, M.D., Cleveland, and Katsuji Kato, M.D., Los Angeles 249

Progress in Pediatrics:

Diphtheria in Infancy. S. F. Ravenel, M.D., Greensboro, N.C. 258

Abstracts from Current Literature 263

Society Transactions:

American Pediatric Society (Third and Fourth Sessions) 302

Book Reviews 321

Directory of Pediatric Societies 323